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Note Upon the Arrangement of the Telegraph Office at the Northern Railway Depot of Paris.

(*Translated for the* REVIEW *from La Lumière Electrique.*)

The arrangement of the telegraph offices of the French railroad companies are little known; they ought to, however, for it may be said of them that they generally present the utmost simplicity, convenience and economy in the selection and arrangement of their electrical apparatus; though it seems difficult that it be otherwise, when the large amount of telegrams transmitted daily upon each system of lines for the requirements of the service is taken into account as well as the comparatively small space devoted to telegraphy in the railroad depots and also when the numerous duties of the employes are remembered.

From the origin of railroads and until lately the railroad companies were using exclusively the Breguet dial telegraph; this apparatus, however, as is well known, is slow and leaves no record of the telegrams, and in many cases was the cause of errors inherent to the system itself, errors which might have very dangerous results.

Fully aware of said defects the electricians of these companies have tried a great number of printing telegraphs; but the sundry systems so far tried or being now in course of trial present on the whole no less defects on account of their being cumbersome and of requiring the supervision of an especial mechanic, or on account of their high price and of the difficulty of their setting up while they work almost as slowly and more irregularly than the Breguet apparatus.

The railroads have then given their choice to the Morse registering apparatus, which takes little room, works quickly, cost little, and is easy to set up.

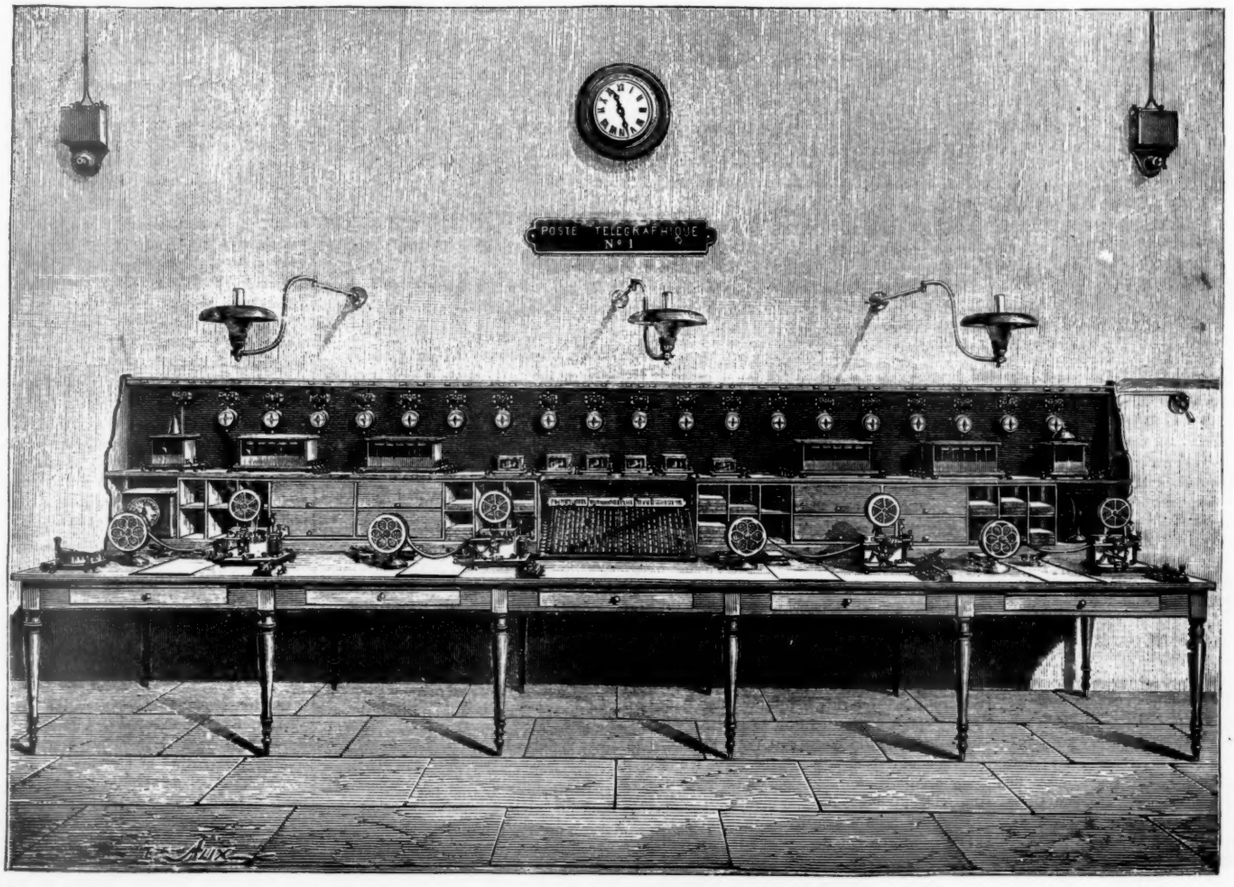
The Eastern Railroad Company has been the first in France to give the example of an almost radical change, and has soon been imitated by the Northern Railway and the Paris, Lyons and Mediterranean Railway.

It is not my intention to give here a description of the sundry telegraphic arrangements of these railroads, though it would furnish matter for an interesting study which I intend to present later to the readers of this Journal. I will confine myself in the present article to the examining of the entirely original arrangements adopted by the telegraphic management of the Northern Railway at its telegraphic office of its railroad depot from which a respectable number of wires are starting.

In some depots or stations of little importance the working of the telegraph apparatus is intrusted to employes who have also some other duties to perform; in the larger stations especial employes take care of the telegraphic service; in some other depots of still greater importance and which are at the ends of the lines, the Minister of Posts and Telegraphs compels the companies to use some of his own employes, and the latter are to see that the railroad companies service be attended to, but their especial duty is also and chiefly to pick out every day the telegrams which do not belong to the railway service and which consequently are not to be transmitted free as those of the latter.

In order to remedy the many drawbacks arising from the arrangement of the Paris office which is in charge of State employes, and in order to quicken the transmitting of telegrams the electrical department of the Northern Railway has ordered the constructing of a table which was shown at the exhibition of electricity in 1881, and which is represented here.

This table is five meters long, and has been arranged to receive twenty distinct transmissions, which are all to-day in use. It is provided with four Morse apparatus, and a Breguet dial telegraph; each one of these apparatus can be used on either one of the twenty circuits by the means of a Swiss commutator or switchboard placed upon a desk in the centre of the table. This switchboard is divided in three series of conducting strips; in the centre there are the twenty strips which correspond to the twenty lines and twenty electric bells; at the right end twelve bells are arranged to give a direct communication in six directions simultaneously; the wires reach these strips, go through six sounders which are upon a shelf above the switchboard. At the left end five strips are set apart, and they are exclusively employed to connect either one of the twenty lines with any one of the five



TELEGRAPH OFFICE AT THE NORTHERN RAILWAY DEPOT OF PARIS, FRANCE.

Morse apparatus, or with the dial telegraph.

Above the twenty lightning arresters, and the twenty galvanometers traversed by the line wires, there are, starting from the left, a bell for urgent calls, four relays for signalling in five directions, the six sounders, the local vibrating bell of the relays, and lastly, very near the latter bell, there is a switch which permits to do away with the vibrator in daytime.

Opposite each Morse apparatus there is a pole changing switch after Tesse and Lartigue plan, two battery switches, one for the weak and the strong battery, while the other serves to take one of the groups of four batteries, in the case where one would happen to fail suddenly, and finally there are some pigeon-holes in which every operator can store printed matter, original dispatches, done by the three State employes who receive help from younger ones in the copying and delivery of telegrams. It must be noticed that there is never more than one employe on duty, who, during the busiest part of the day, is helped by the younger attendants in the transmitting and receiving of telegrams. They thus train young operators who shall be able later to be employed in other railroad depots for the telegraphic service.

The mounting of the Paris table just described has been made in the workshops of the Société Générale des Telephones, by workmen from the Digney firm.

ENG. SARTIAUX.

The Electric Light in the Magasins du Louvre, Paris.

Our esteemed contemporary, *Engineering*, in speaking of a previous article published on the above installation, says that we explained that this installation, very carefully arranged in a practical point of view, is directed with great care, and that a very detailed account is kept of the expenditure involved. The figures we shall now give, and which we owe to the kindness of M. Honoré, are therefore absolutely exact; they are deduced from a careful examination of the official accounts, and refer to the year 1882, during which the electric lighting of the Louvre was conducted under normal conditions, without any change or interruptions.

As we stated in our previous article, the lighting of the Louvre is effected by five Gramme machines with independent excitors; each of these supply eight circuits of three Jablochkoff candles, or 120 in all. There are also two Meritens machines, each of five circuits, feeding thirty candles in all, or a total of 150; there are, besides, four other dynamos, each working an arc lamp, and one Edison machine, type Z, supplying sixty incandescence lamps.

The expenses relative to this installation have been separated from the general accounts, and divide themselves into three classes, as follows:

1. Those of first cost.
2. The running cost of the lamps.
3. The cost of maintenance and working.

In any ordinary installation the first costs are generally easy to arrive at; the second are usually calculated more or less approximately; as regards the third, it is rarely that running and maintenance charges are recorded with accuracy; these, however, are the most important of all.

During 1882 the Jablochkoff candles, many of which it will be remembered burn during the day as well as at night, gave a total of 204,578 hours; the four arc lamps furnished each 738 hours, or a total of 2,952 hours; as they are each equivalent to five candles per circuit, as far as mechanical work is concerned, their proportional part corresponds to $2,952 \times 5 = 14,760$ hours. The sixty Edison lamps more recently placed, furnished during the months of November and December last, 26,205 hours of light, but each of them absorbed only 0.2 of the power taken by a candle, so that their proportion of power absorbed was $0.2 \times 26,205 = 5,241$ hours. We have thus a total of 224,579 light hours of equal intensity. The foregoing is the basis from which the distribution of expenses, management, fuel, stores, &c., has been arrived at for each of the different systems.

The 204,578 hours of lighting supplied by the Jablochkoff candles correspond to a total of 133,246 candles consumed; hence the average duration of each candle was about 1.5 hours. This part of the expenditure works out, at the price at which the candles are supplied to the Magasins du Louvre, to .124 franc (1.19) per hour; the cost of working and maintenance corresponds precisely with the same figure; as to the allowance for sinking fund, calculated at 10 per cent. for interest and amortization of all the capital invested in the installation—for boilers, steam power, material of all kinds, conductors, lamp brackets, &c.—it corresponds to a total of 0.145 francs (1.39d.).

The whole of the expenses therefore amount to 0.393 francs (3.79d.) per hour, divided as follows:

	FRANCS.
Candles	0.124
Motive power and maint'ce.	0.124
Sinking fund and interest	0.145
Total	0.393 (3.79d.)

The cost of the arc lamps is made up as follows:

	FRANCS.
1. Of the carbons consumed, which, divided by the 2,952 hours of lighting, cost per hour	0.221
2. Of the maintenance as before	0.620
3. Of amortization charges.	1.001
Total	1.842 (17.68d.)

Lastly, the account for the Edison lamps stands as follows, allowing a service of 800 hours per lamp:

	FRANCS.
First cost 7.5 francs (6s.)	0 0094
Maintenance	0.0248
Amortization	0.0191
Total	0.0533 (.51d.)

It should be observed here that the general expenses connected with the production of motive power are, in the original accounts, grouped together, and that the distribution made has been arranged proportionally among the different systems, whilst the expenses special to each system, are in all cases kept separate.

An observation should here be made on the hourly consumption of the Jablochkoff candles Until the year 1883 the lighting of the candles was carried out in multiple chandeliers at the Magazins du Louvre, and with hand commutators manipulated by an attendant, when it was necessary to substitute a new candle for one that was burning out. In consequence of this, in order to avoid extinction, it was necessary to be always a little in advance, and consequently to sacrifice a certain amount of the candle which was not burnt. Moreover, when the candles in the first chandeliers of a circuit were lighted simultaneously, it was necessary to regulate the change either by the candle which had burnt the quickest, or by the shortest one of the group. From this it followed that none of the candles were entirely consumed, and a considerable waste was entailed. The suppression of this loss was a problem which long occupied the attention of those using the Jablochkoff candle, and many special devices have been schemed for the automatic lighting of the candles. Unfortunately, all these arrangements, more or less complicated, have failed to answer in practice, although great ingenuity has been exercised on the subject. At the Magasins du Louvre, the practical management of the electric lighting is placed, under the superior direction of M. Honoré, in the hands of a chief electrician, M. Clariot, for a long time in the employment of the Jablochkoff Company. This gentleman has carried out an idea at once very original and very practical, by which, at an increased cost of something less than one centime per candle, the relighting can be effected automatically and without any failure, and to secure an economy of twenty per cent. on the consumption of the candles, by avoiding the constant loss of unburned ends of candles. This arrangement of M. Clariot, the description of which we must postpone for the present, thus prevents large losses without any delicate mechanism, and with a certainty that has never failed. Thus modified, the cost of the Jablochkoff candle per hour is

	FRANCS.
Candle	.104
Maintenance	.124
Sinking fund	.145
	.373

In order to afford a means of calculating in what proportion the various systems of electric lighting which have replaced gas are more economical than the latter, we may add that the Magasins du Louvre pay at present for gas .30 franc per cubic meter (6s. 9d. per 1000 feet), which is equivalent to a cost of .054 franc per burner of 180 liters per hour (6 cube feet). The maintenance would come to .008 franc, and the amortization of the installation, calculated on the same basis as for electricity, to .014, or a total of .072 franc (.69d.) per hour and per burner of 6 feet of gas. The total cost of gas lighting is thus raised to about 8s. 6d. per 1000 cubic feet. We have already seen in the previous article that there has been established at the Louvre one Edison lamp for one gas burner of 6 feet, and one Jablochkoff candle for about ten such burners, while more lately five candles in one circuit of a De Meritens machine have replaced a Berguet arc lamp.*

Consequently, if we compare the cost of lighting by each system, with the light furnished by one cube meter (28.3 feet) of gas, we shall have the following values:

	FRANCS.
Cost of gas per meter	.394
Edison lamps $\frac{.0533}{.180}$	.296
Jablochkoff candles without the Clariot device $\frac{.393}{1.800}$	.218

Or calling the cost of gas 1, that of the Edison and Jablochkoff lights are .75 and .553 respectively. By comparing M. Clariot's arrangement for relighting the candles, the cost is reduced to $\frac{.373}{1.800} = .207$ and that for the arc lamp is $\frac{1.842}{9.400} = 195$; these compared with gas taken as unity, stand at .52 and .495 respectively. The cost of lighting the gas at the burners, and that of the electric lights, is not included in the comparison, which supposes that in either case this work is done by the staff of firemen retained permanently by the establishment. If, however, this item was estimated, it would increase the cost of the gas lighting and of the Jablochkoff candles without the Clariot apparatus, and would not affect the other systems.

We may now examine a little more closely the cost of lighting by the Jablochkoff system, which has been most elaborated in this installation. We see that in the cost per hour (.373 franc) the cost of the candle itself is only a small item, and is one that will be still further reduced, to a certain extent, by further developments to be made in manufacture. Consumption and maintenance correspond to .124 franc hourly. But little saving can be looked for in this direction, because the steam engines employed at the Louvre are of a very economical type, and consume a minimum quantity of coal per hour. With extravagant engines this element of cost would run up very rapidly, which shows that the selection of a good motor is of primary importance in obtaining economical conditions in electric lighting. The sinking fund for plant and material forms a heavy item. The cost of electric machines and conductors is a large proportion of the whole, but one which it may be fairly hoped will in time be reduced. The principal attention of many electrical engineers is directed now, not towards new inventions, but to cheap production, and advance is made in two different ways by improvement in construction, and by making larger and more powerful machines. Thus, of the three elements of cost, the first will be gradually reduced to a small extent by improvements in the production of carbon; the second must remain nearly constant, as but little economy can be made in motive power. Thanks to the employment of more powerful electric generators the third source of expense may be considerably diminished, since the current can be produced more cheaply on a large scale, and the first cost of installation can be reduced.

But little remains to be added to complete this description of the electric installation at Magasins du Louvre. Reference has been made to one of the generators employed for the transmission of power to a distance. The current produced by this machine flows through a circuit of insulated wire which crosses the Rue St. Honoré and goes to one of the smaller buildings belonging to the establishment. Here the wires are connected to a second Gramme machine, which drives an air pump by means of which the small balloons that are given away are inflated. At one time this work was done by two men driving a hand-pump, who were occupied the whole day. The transmitting and receiving Gramme machines do this work in six hours, during which time they fill from 800 to 1,000 balloons. There is in addition a second and more important installation, but not yet completed, so that its description must be deferred for the present; this is in a large building erected near the Champs de Mars, where, amongst other things, furniture covered with stuffs, such as sofas, chairs, &c., are made. This workshop contains a number of sewing-machines which will be driven by the current. When the installation is completed we shall describe it in detail.

* Photometrically, five Jablochkoff candles approximate very closely to one Berguet lamp; actually, however, the luminous value is higher, on account of the greater facilities for distributing the light.

The New High-School Telescope.

THE INSTRUMENT TO BE MOUNTED EARLY NEXT MONTH—A SPLENDID 10½ INCH GLASS.

Mr. Alvan Clark, of Cambridge, expects to have the object-glass for the new telescope at the High School ready by the early part of next week. A letter from Mr. Swasey, who is to mount the instrument equatorially, gives information that he will be here early next month. He says that he will be able to give a first-class observatory in every particular, and that the equatorial mounting will have some important improvements which will commend themselves to astronomers.

The instrument, a fine 10½-inch glass, will be mounted on a solid piece of stone weighing between two and three tons, supported by three iron bars fifteen inches thick, immediately beneath the dome. It will thus be completely detached from the floor of the observatory, and subject, Mr. Swasey says, to no jarring.

Though the building will hardly be completed before October or November, it is intended to finish the observatory at once, so that the present class may have the benefit of its use.

London *Engineering* says that the Maxim-Weston Electric Company, Limited, have, during the National Eisteddfod, at Cardiff, lighted the building and adjoining grounds in which the ceremonials and concerts were held. This building, which has been erected by the Taff Vale Railway Company for locomotive sheds, and was lent by that company to the Eisteddfod Committee, was lighted by fourteen Weston arc lamps, arranged on three circuits, which each extended outside the building to the different entrance gates and grounds, as well as to the temporary platform of the Taff Vale Railway. Thirty-four lamps, each of 1600 candle power, were used; by dividing the lamp circuits in the building into three, and driving one of the dynamos from an independent engine, the chances of total darkness, even for a moment, were reduced to almost *nil*, but we are glad to be informed that the light during each night was most perfectly satisfactory, and for evenness and steadiness left little to be desired. The Fine Art Galleries were lighted by Maxim incandescence lamps of 50 candle power, driven

off a Maxim machine; this lamp when driven up to its full candle power gives a very pure light, which is particularly well adapted for pictures, and was very much admired by the numerous visitors. The installation has also been used for two concerts, and for two dinners given to the employes of the Taff Vale Railway, held in the same building.

Calibration of a Galvanometer.

PAPER READ BEFORE THE SCIENTIFIC ASSOCIATION AT MINNEAPOLIS, MINN.

SECTION B—PHYSICS.

Prof. Rowland being absent, Prof. Mendenhall acted as vice-president *pro tempore*.

The first paper was entitled "A Method for the

CALIBRATION OF A GALVANOMETER,"

by Prof. B. F. Thomas. The method consists in passing a current of electricity through the galvanometer and noting the deflections of the needle, the strength of the current being known. Any kind of a battery may be placed in a circuit with a sensitive galvanoscope. The paper was extensively illustrated by blackboard illustrations impossible to describe without drawings.

The next paper, "On a New Form of Selenium Cell and Some Remarkable Electrical Discoveries made by its Use," by Prof. C. E. Fritts, an abstract of which was read, in the absence of its author, by Prof. Mendenhall, and showed technically one of the wonders of electricity.

Prof. H. T. Eddy, of the University of Cincinnati, then read a long paper upon the "Liquefaction, Vaporization and the Kenetic Theory of Solids and Liquids."

A paper entitled "A Kenetic Theory of Melting and Boiling," by the same author, followed. He considered the probable physical state of two bodies in a solid condition, especially as to the amount of energy distributed in them and the atomical freedom possible in such bodies.

A discussion of the subject followed, partaking largely of a technical nature.

The next papers were by the same author upon "An Exposition of the Theories of the Virial to the Rotary Oscillation," and by Prof. Gustavus Hinrichs of Iowa, entitled "Remarks on the Tracings of Self-Registering Instruments, and the Value of the Signal Service Indications for Iowa in June and July, 1883." The speaker did not believe the United States signal service was as exact and reliable in its prognostications as was expected. He showed that the stations in his State, although of sufficient number, were not exact in their reports, and did not send reports sufficiently frequent to make the forecasts anything better than mere conjecture. Three out of nine days on which no rain was predicted, it did rain, and on other days when rain was foretold, it remained dry. Six out of twelve predictions were far from correct and could not have missed it farther if they had been mere guesses. A spirited discussion followed which occupied the remainder of the session. Profs. Mendenhall and Nipher defended the system of weather signals, the former considering the speaker too severe in his criticisms. But the essayist asserted that only 50 per cent. of the Iowa predictions were correct, being in his opinion, an entire failure practically.

Edlund is continuing his researches upon rarefied air as a conductor of electricity. A number of experiments are described to show that the phenomena of the opposition to the passage of sparks from terminal to terminal in rarefied air cannot be explained by the theory that a vacuum does not conduct electricity. He carefully discusses the question of the contrary electro-motive force which is developed at the terminals. "It is not the resistance of the gas but this electro-motive force, increasing with the rarefaction and connected with the electrodes, that presents an obstacle to the passage of the current. Everything is in favor of the hypothesis that vacuum opposes a very feeble resistance to the propagation of electricity." Without the employment of electrodes, one can excite an induction current in a Geisler tube, which is sufficient to produce light. This would be impossible if the highly-rarefied gas or vacuum were an insulator.

In speaking of the rapid progress of the electric light, the London *Electrician* says: The electric light which has proved so useful in many of our harbors at home, is now finding its way to our colonial ports. Amongst others, Lyttelton, New Zealand, has made trial of it. A description of the inauguration of the Brush light at Lyttelton Harbor has just reached us From this it appears that the New Zealand Electric Light and Power Company, early in this year, entered into a contract with the Lyttelton Harbor Board for fitting up a 16-light Brush plant for the sum of £1,000 subject to a two months' trial of the efficiency of the system. The installation was completed about the 1st of May last. We take the following details from the Lyttelton *Times* of the 21st of May last:—"It consists of 16 Brush arc lights, each of 2,000 candle-power, erected on the works surrounding the inner area of the harbor. Three of these are at the graving dock, two on the steamers' wharf, four on the Gladstone pier, and the remainder distributed singly on the various other wharves. Each lamp is fixed upon a kauri post about 30 feet in height, and is protected by a kind of hood, the interior of which serves the purpose of a reflector. The 'cable' connecting the lamps with the dynamo is laid underground in wooden piping from the dock to Peacock's wharf, a distance of about 1,000 yards. Thence it is conducted to and along ths Gladstone pier in a wooden casing, protected by iron capping, fixed beneath the planking of the wharves. The cable passes to the lamps along grooves cut in the posts, and covered with boards nailed on the post. The circuit is completed by a submarine cable laid across the basin from the Gladstone pier to the dock. Earth plates have been provided in order to continue the working of the system should this cable be injured. The dynamo machine, which is of the newest English pattern, is lodged in a compact little building constructed of iron, and match lined, adjoining the end of the dock engine house. The machine is capable of working up to 800 revolutions per minute. In the building just alluded to is the steam engine used for driving the dynamo It is a high pressure condensing engine of 16 horse-power nominal, running at a speed of 110 revolutions per minute, and was made by Messrs. Scott Bros., of Christ-church. Steam is supplied to the engine from one of the boilers of the dock pumping machinery. It was at first intended to use one of the dock engines for the dynamo, but as such an arrangement must, under any circumstances, have been of a temporary character only, it was finally decided to erect a special engine for the purpose. In conclusion, it may be mentioned that the whole of the work in connection with fitting up the installation has been done by Mr. Prince, engineer to the company, ably assisted by that enthusiast in electrical matters, Mr. Meddings, and the officials of the Harbor Board." As a matter of course, the inauguration of the lights, which took place on Saturday night, the 19th May, was made the occasion of considerable feasting and toast drinking, the Lytteltonians evincing interest in the new system of lighting. According to the report of our contemporary above mentioned, the new light was a decided improvement on the old gaslights. It may be mentioned here that the first negotiations for the introduction of the electric light into Lyttelton were carried on by Sir Julius Vogel, as the representative of the Australian Brush Company, but were subsequently completed by the New Zealand Company, who acquired the Brush patents from the Australian Company.

It has been estimated by American statisticians that the earnings and savings, or rather that the surplus capital, annually accumulated by the people of the United States may be considered to amount to about $1,000,000,000. The magnitude of this sum is so great as to occasion some doubt as to its accuracy and to inspire an English writer on this subject with the notion that it is a mere guess. Nevertheless, be the sum exaggerated or not, it is admitted on all sides that the country has now become self-supplying in the matter of capital for the development of its resources, and for such improvements as are indispensable to the regular growth of its civilization.

Encouragement to Inventors.

In commenting upon patents in the United States, the *Manufacturer's Gazette* says:

There is no country more favorable for the inventor than the United States. By wisely-framed patent laws, which are vastly preferable to bounties, inventive genius is stimulated to action, and the cost of obtaining patents is so light as to debar few from the privilege. In this respect the United States presents a marked contrast to England, whose patent fees are much higher than our own. In England the cost of patent protection for fourteen years amounts to about $875, whereas America protects her patentees for seventeen years for the sum of $35. An English trade journal not long ago asserted that England was getting somewhat behindhand in her struggle for manufacturing supremacy, owing to the excessive cost of obtaining patents in that country, and pointed to the United States as an example worthy of imitation in this respect. Perhaps the American has a keener insight into the requirements of the age and a greater versatility of resources than his English brother, but these traits have surely been developed through patent legislation.

It is unnecessary to touch upon that phase of communism which opposes the granting of patents, or at least wishes to restrict the time of such to insignificant periods which will not recompense the inventor. Of course it is but a simple act of justice to secure to the inventor the result of his brain work, as well as to the workman in other fields of industry the result of his hand toil. One apparently simple, yet important, tool used in shoe manufacture required seven years to perfect. The inventor should certainly receive remuneration for his time and application. Patenting may be considered a kind of technical education, and though inventors may produce thousands of worthless articles, yet there is sufficient gold out of the dross to make our patent system worthy of all encouragement.

Dr. Dobbie, and M. J. Hutcheson, of Glasgow, in a course of certain experiments on the action of electric currents upon a solution of common salt, found that there is a formation of hypochlorite of soda—*i.e.*, bleaching soda. If the solution is neutral, there is an escape of chlorine during the action of the electric current, while a certain quantity of hypochlorite remains in the liquid. If the solution is kept alkaline, all the salt is converted into hypochlorite. If it is made acid, all the chlorine escapes, and no hypochlorite remains in the solution. Experiments on the subject are now in progress in a Scottish bleach works on a large scale. The yarn or cloth to be bleached is saturated with brine, and passed between two rollers, each of which is in connection with one of the poles of a galvanic battery. The current passes through the moist goods and produces hypochlorite of soda (bleaching soda), or free chlorine, according as the solution of salt was alkaline or acid. In the former case the goods must be taken through sours to complete the bleaching; in the latter case this is not necessary. Discharge styles upon cotton goods can be produced with rollers, which are partly covered with non-conducting materials. The current then passes only through the parts left uncovered. An advantage of the new process for bleaching is that in many cases it will supersede the previous bowking and washing, as the electric current has a decomposing action upon the resinous impurities.

A new battery has been devised by MM. Lelande and Chaperon. It is a single-cell one. The liquid used is caustic potash. The depolarizing electrode is oxide of copper and the other pole is made of zinc. This electric battery is manufactured in various forms. In electro-motive force is nearly one volt, and it is said to give a steady current through even a low resistance for a good many hours. When the power, or rather energy, is exhausted, the battery can be restored to its first condition by sending a current through it from an accumulator.

Gerard's Alternating Current Machine.

This machine consists of a movable inductor, whose alternate poles pass in front of an armature composed of a double number of oblong and flat bobbins, that are affixed to a circle firmly connected with the frame. There is a similar circle on each side of the inductor. The armature is stationary, and the wires that start from the bobbins are connected with terminals placed upon a wooden support that surmounts the machine.

This arrangement allows of every possible grouping of the currents according to requirements. Thus, the armature may be divided into two currents, so as to allow of carbons 30 mm. in diameter being burned, or else so as to have four, eight, twelve, twenty-four, or even forty-eight distinct circuits capable of being used altogether or in part.

This machine has been studied with a view of rendering the lamps independent; and there may be produced with it, for example, a voltaic arc of an intensity of from 250 to 600 carcels for the lighting of a courtyard, or it may be used for producing arcs of less intensity for shops, or for supplying incandescent lamps. As each of the circuits is independent, it becomes easy to light or extinguish any one of the lamps at will. Since the conductors are formed of ordinary simple wires, the cost attending the installation of twelve or twenty-four lamps amounts to just about the same as it would in the case of a single cable.

Chemical Resources of Florida.

To awaken a general interest in the chemical resources of Florida, and develop them with that energy and enterprise everywhere seen throughout the State, would open new resources of revenue and lay the foundation for permanent prosperity. They include everything that can be worked up by chemical art into a valuable article of commerce, as medicinal plants, fragrant flowers, and unsalable fruit and vegetables. And when we consider the facility with which many of them can be worked, and their commercial value, is a matter of surprise as well as regret that they have not long since given rise to various branches of industry. While the general climate of Florida is known and appreciated, and draws its thousands from the frozen North, the wealth of her luxuriant and varied vegetation should certainly receive attention; and the manufacture of fluid extracts, oils and chemicals should be among her most important interests.

Why cannot volatile oils be made here and an industry fostered for which we are largely dependent on Europe? And why cannot citric acid, potash, starch, sugar, tannin and Epsom salt be made here cheaply and profitably? These are questions of practical importance.

Citric acid is found abundantly in the juice of lemons, limes and sour oranges; also in the juice of other fruits, as cranberries, whortleberries, gooseberries, currants, strawberries, red elderberries, blackberries and tomatoes. Nothing is more encouraging than the manufacture of citric acid, as nearly all its sources are in Florida. And the process for preparing it, as given by the dispensatory, is very simple.

The manufacture of potash is suggested by its abundance in the palmetto. This plant, when dried and burned, yields a larger per cent. of potash than any other vegetable substance. The ashes are put into wooden cisterns, having a plug at the bottom of one of the sides under a false bottom, a moderate quantity of water is then poured on the mass, and some quick lime is stirred in. After standing for a few hours, so as to take up the soluble matter, the clear liquor

is drawn off, evaporated to dryness in iron pots, and finally fused at a red heat into compact masses. But potash may be obtained from all kinds of plants.

Starch is especially abundant in wheat, rye, barley, oats, rice, corn, peas, beans, acorns, potatoes, arrow-root and the cassava plant; also in palmetto. These are reduced to a state of minute division and washed with cold water. The milky liquor is poured off and allowed to stand until the starch subsides. This washing should be repeated as long as the water takes any perceptible color. The starch is then drained and dried. In operating on damaged material chlorine water would be preferable.

The sources of sugar are also numerous, and the method of making it well known, but the importance of refining it here are not fully appreciated.

Tannin is most frequently obtained from nut-galls. It may be obtained, however, from a variety of vegetable substances; in fact, from all astringent plants. Among its sources in Florida may be mentioned the pitcher plant, sumac, pomegranate, palmetto and oak, and, as there are several processes for preparing it, we would recommend that by Pelouze as simple and productive, which consists in treating the powdered substance with ether by perculation.

Epsom salt is a constituent of sea-water, and may be easily procured, as a by-product, in the manufacture of common salt, by carefully evaporating the brine after the crystallization of the salt. During the war large quantities of it were thus made on the coast. The war taught us several lessons of practical chemistry; we made sugar of lead, copperas and blue stone as well as fluid extracts.

Time would fail us to enumerate all the chemical resources af Florida. They are everywhere around us. And the reader can no doubt think of many not mentioned. We hope, however, that the few briefly noticed may stimulate to further inquiry and lead to their development.—*Monticello Constitution.*

The Nothomb Electric Lamp.

The Paris *Electrician* says that this incandesence lamp is distinguished from its predecessors by the nature of the incandescent filament and the mode of manufacture. This filament consists of cellulose carbonized in a carburetted atmosphere which impregnates it with carbon. It is one millimetre wide and four-tenths of a millimetre thick; its length depends on the luminous intensity required. The atmosphere of the globe of glass in which it is inclosed consists of azote, hydrogen, or any other inert gas.

The filament is fixed to conductors by means of a special kind of cement, composed of a mixture of spongy platinum and an organic substance, molasses or sugar, which on carbonizing, forms carbon of very close texture and great consistency. The duration of the lamp, according to the experiments made, should be from 800 to 1,000 hours; the luminous power 30, 50, or 100 candles; there are thus four types, A, B, C and D, which work with currents of from one to three amperes and electro-motive forces of from 45 to 100 volts, according to the luminous power.

By calculating the expenditure of energy corresponding to these constants and comparing it to the luminous power, we see that the Nothomb lamp, like all the incandescence lights, gives a light of from 250 to 300 candles per horse-power of electrical energy.

The type D, of 300 candles, has three filaments, it requires 100 volts and nine amperes, or 300 volts and three amperes, according to whether the three filaments are coupled in series or parallel. While adopting the horse-shoe form of filament, the inventor acknowledges that the best results have been obtained from the spiral ones. The same effect has been noted with incandescent conductors formed of spirals of platinum wire which require a smaller amount of electrical energy to bring them to a certain degree of incandesence when they are coiled into a spiral than when they are straight or merely loop-shaped. It is probable that the difficulties in manufacturing the spiral carbon filaments alone prevent their employment for industrial purposes, for they would effect a real economy of motive power, a most important point in electric lighting by incandesence.

Electrified Liquor.

A NEW PROCESS TO TAKE THE POISON OUT OF ALCOHOL.

The latest and certainly the strangest use to which electricity has been put is to a process of "giving age" to whisky and wines. It is the discovery of a Californian, who has succeeded in getting patents from the United States and has at the same time interested the Internal Revenue Commissioner to such an extent that special privileges to experiment with bonded whisky have been accorded him. A series of trials are being conducted at a store on Washington street, between Montgomery and Sansome, under the supervision of a Deputy Revenue Collector. The process in question is exceedingly simple, and if all is true that is claimed for it, it will revolutionize the liquor and wine trade. It is nothing more than a quick and cheap method of refining, that being done in from twelve to forty-eight hours which formerly required years to accomplish. Those who use wine and liquors know from experience, and those who are abstemious and religious know from the good book that there is something wrong with "new wine." Our forefathers knew as well as we do at this day that wine needs age to make it good. It is apt to taste "after the soil," as the connoisseurs call it. If whisky had been a beverage 2,000 years ago the same tongues which found fault with new wine would also have detected a sharp biting taste in new whisky, which they would not have found in whisky a few years old. In the case of whisky it is an abundance of fusil oil which causes the firewater taste, and it has heretofore always been supposed that nothing can remove it except time. For this reason new whisky is seldom put into the market. Instead it is sent into a United States bonded warehouse, where it remains under lock and key for one, two or three years, gaining greater value the older it gets. The Government will allow whisky to remain in bond but three years. After that time the tax must be paid and the whisky removed. When it is desired to turn out an exceptionally fine quality, it has to be kept a few years longer in regular storage, and the older it gets the better, it is alleged, becomes its quality. The process is expensive because it costs storage, interest and insurance, to carry whisky from year to year. It is similar in the case of wine, which requires age even more than whisky to give it flavor. Now all this it is claimed the electric process can accomplish in a few hours, and the manner in which it is done is as follows:

Two blocks of carbon wrapped up in flannel are inserted tn the liquor to be purified and these carbons are connected with the positive and negative poles of an ordinary Brush electric machine. Electricity is then generated by the usual means and the process of purification and refining proceeds. The chemical action upon the liquor is such that all impurities are attracted to the negative carbon-covering flannel. The excess of fusil oil also finds lodgment here, and when the cloth is removed, it looks as if it had been steeped for a day and a year in Tar Flat brine. It is asserted that the liquor does not lose proof during the process. Light wines require about two hours of this electric churning; fortified wines are rendered mellow in twelve hours, and the hardest and deadliest sample of alcoholic distillation is made comparatively harmless within forty-eight hours. If all that is claimed for the invention is founded on facts its importance upon the winemaking industry can hardly be overestimated. It will then be no longer necessary to send casks of port on sea voyages around the world, and Eastern wine merchants need no longer have recourse to the prevarication that French wine, having undergone a sea voyage, is necessarily better than the domestic product. Age, the great desideratum for California wines, can be produced with the aid of a dynamo-electric machine. Every saloon can own a little machine, turned by hand, dog or steam, and every person can be personally convinced that the liquor which is set before them is electrically pure and old. "Give it a shock," will become as common as "A little water, please," the sting will be taken out of many a temperance speech and *mania a potu* will no longer be dubbed "horrors."

In New York it is worthy of note that the Brush-Swan Electric Light Company, which employs the Swan (English) incandescent electric lamp, has begun putting in fixtures, and a consignment of new accumulators having arrived (the same to be supplied by the Brush arc light wires), several buildings are to be fitted with this rival light to that of Edison. A bank on Broadway will employ the Swan lamps, and the Madison Square Theater is awaiting accumulators to put in that light. In reference to the use of the Swan lamp in theaters, it is claimed by Mr. Brush (and it is notable if successful) that he has devised a means of regulating the current at will, so that the incandescent lamps may, as it were, be "turned up and down" gradually, in order to produce stage effects.

A second electric boat, 46 feet in length and capable of carrying fifty passengers, has just been launched upon the Thames. The motive force lies concealed in 70 boxes, each of 1-horse power, stored under the floor of the boat, and at the end there is a Siemens dynamo, the spindle of which is continued so as to form the screw, without intermediate gearing. A speed of 9 miles an hour can be maintained for six or seven hours, when the secondary batteries have to be replenished. There is no noise or heat or smoke or smell or waste, and the machinery takes up so little room that practically the entire boat is available for passenger accommodations.

A catalogue published by the German Pomological Society enumerates 839 kinds of apples, 912 of pears, 235 of cherries, 289 of plums, 108 of peaches and 35 of apricots.

The annual report of the chief of the Bureau of Statistics on the foreign commerce of the United States shows that the imports and exports of merchandise during the fiscal year amounted to $1,546,928,485, being larger than during any previous year in the history of the country. The value of the exports of merchandise exceeded the value of the imports of merchandise $100,683,153, as against a similar excess during the preceding fiscal year of $25,902,683. The value of the exports of merchandise from the United States during the year ended June 30, 1883, amounted to $823,805,829, as against $759,542,257 during the preceding fiscal year, showing an increase of $73,263,562.

The value of the imports of merchandise into the United States during the year ended June 30, 1883, amounted to $723,122,660, and was exceeded only once before, namely, during the year ended June 30, 1882, when it amounted to $724,639,574.

The electric bolt that hits an oil tank becomes "greased lightning," doesn't it?

The Vienna Electric Exposition.

The Vienna Electric Exposition is now open. The motive power is provided in the large machine department which encompasses the court-yards where the steam boilers, representing in all 1,200-horse power, have been placed.

The rotunda is devoted exclusively to the practical application of electricity, and is, therefore, to the public at large the most interesting part of the entire exhibition. The machinery department, besides showing how electricity is produced and applied, gives the expert a chance of judging for himself. The large gate of the rotunda is lighted with incandescent lamps, and a dozen large arc lights on elevated masts surround it.

The engineers who have arranged the exhibition found it very difficult to light the rotunda in a manner to give the public an adequate idea of the value of electricity as an illuminating power. The diameter of the rotunda (built in 1872 by Scott Russell) measures 130 meters, its greatest height 66 meters.

It was therefore impossible to illuminate the entire building with incandescent lamps.

Along the gallery which runs round the so-called lantern, about 24 meters from the ground, is placed a garland formed of 112 arc lights. At double the height are placed 28 very powerful arc lamps, and in the center of the lanterns, at the height of 60 meters from the ground, shines a light of 20,000-candle power.

All this light proved insufficient to illuminate the colossal hall; 56 more large arc lamps were therefore placed within the arches resting on pillars, and forming the large circular gallery. In the center 36 more arc lights were placed, so that the total amount of light within the rotunda is 250,000-candle power.

The machinery department and the court-yards are lighted as brilliantly as the rotunda.

The theater forms a conspicuous feature in the electric exhibition. It is 340′ long and 48′ wide, and is entirely illuminated by incandescent lamps provided by the firm of Granz & Co., Budapest.

Of the 1,200 Swan lamps 15 are placed in the entrance hall, 90 in the several anterooms, 104 in the body of the theater, 30 in the orchestra and 90 in the dressing-rooms at the back of the stage. There are 1,260 small lamps besides for lighting the stage, and these can be changed to any color at the turning of a handle.

The engine and dynamo room are in the machine hall 350 yards distant, the conductors being laid underground. Experiments are also being made to light the theater with arc lamps, which would be much less expensive. The public can judge for itself of the merits and defects of both systems.

While the center of the rotunda is filled with all the appliances of telegraphs, &c., that part of the gallery which is not reserved for the theater contains a number of "interiors,' showing the application of the electric light to private houses. Every kind of appartment is shown, from the rich man's luxuriantly furnished salon to the poor man's simple kitchen—and everywhere the electric light serves its purpose.

From the private apartments we pass on to an art gallery, where the effect of the electric light on pictures can be judged. Beyond that is a reading-room, where the public can consult the entire literature of electricity, and last of all are the rooms for telephonic music.

The committee found great difficulty in deciding which locality was best suited to this part of the exhibition, the accumulation of electric conductors being so great in the rotunda that the telephone was likely to suffer from their influence. For the same reason these rooms could be but sparingly lighted. An arrangement has been made with the directors of the Opera-House, according to which the visitors of the electric exhibition will be able to hear the music and singing going on in the Opera-House without moving a step out of thelrotunda.

The total number of exhibitors is 600, representing 13 nations in all—viz.:

Austria, Hungary, the German Empire, France, England, America, Belgium, Russia, the Netherlands, Italy, Sweden, Switzerland, Denmark and Turkey.

There are 52 great boilers, 30 of which are stationary, while 22 are locomotive. The number of motors is 65, of which 52 are fed by steam, 11 by gas and 2 are caloric. There are 150 dynamo-electric machines. The total steam power represents 1,400-horse power, from a machine of ¼-horse power (set to work a sewing-machine) to a giant motor of 240-horse power. The exhibition comprises 15 different kinds of accumulators, including the very latest inventions in this branch of electricity.

Morin's Solenoid Candle.*

When, in 1876, Mr. Jablochkoff had invented his candle, the enthusiasm excited by this new light was simply due to its simplicity, this contrasting so strongly with the complication of the regulators that were then being used. But, while the candle showed its good qualities on being used, it soon also exhibited its defects and desiderata. Among the reproaches brought against it, the one that seemed to be the gravest was the impossibility of relighting it after it had been extinguished. Let us say at once that although this drawback still exists in the candles that are at present employed, the same importance is no longer attached to it. But, at the epoch of which we speak, the defect appeared to be a capital one, and so endeavors were made in various ways to remedy it.

As long ago as 1878, Mr. H. Wilde invented a candle that overcame the difficulty; and after him succeeded Messrs. Jamin & Debrun, whose apparatus were scarcely anything else more or less distant relatives of that of Wilde. In the Wilde burner one of the carbons remains stationary while the other is movable and connected by a lever with the armature of an electro-magnet. When not in operation, a counterpoise causes the point of the movable carbon to rest upon that of the fixed one, but, as soon as a current passes, the electro-magnet establishes a parallelism again between the two carbons, and the arc bursts forth between their two extremities. This very simple arrangement has not, however, realized all the expectations that were had of it, not as regards relighting, which is always effected well enough, but on account of the numerous oscillations that the light exhibits, and which are due in part to the action of the electro-magnet. Moreover, when one candle was consumed, a break intervened before the current could be passed into the following.

These are disadvantages that Mr. Morin, engineer of the Parisian Electric Lighting Company, has sought to overcome by the new arrangement that we shall now describe.

In these new apparatus, Mr. Morin has substituted for the electro-magnet a solenoid whose action is, it is true, less energetic, but which acts at a much greater distance; so that, instead of the violent and instantaneous action of the electro, we have a progressive one which avoids the metallic vibration produced in the first case, the noise from which was often louder than that from the arc itself.

On increasing the dimensions of the apparatus slightly the solenoid has been given a much greater power, and it has become possible to place four burners in the same apparatus, thus permitting of obtaining a lighting of long duration without there being any need of renewing the carbons.

In this arrangement the lighting is effected as in the former one. When the current passes, the solenoid iron, which was held in a certain position by a spring, makes a movement in a direction transverse to that of the wire until a cam has reached the movable carbon-carrier of the first candle and produced an arc. When the current ceases, the solenoid iron is drawn back to its initial position by a spring, and the carbons again come in contact.

In order to obtain a successive and automatic lighting of the different candles, the fixed carbons are held by a small bit of zinc wire, *Z*, which burns as soon as the arc has, through wear, reached a definite height. Then the fixed carbon, being no longer held, falls from its support, and the arc is again broken before it has been able to impair the apparatus. But, as the current is again closed by the other candles that are in contact, the iron strip, *A*, revolves until the second cam brings about a lighting of the second candle, and so on. The passage from one candle to another is effected very rapidly, and so much so that it would scarcely be possible to note the moment when it occurs.

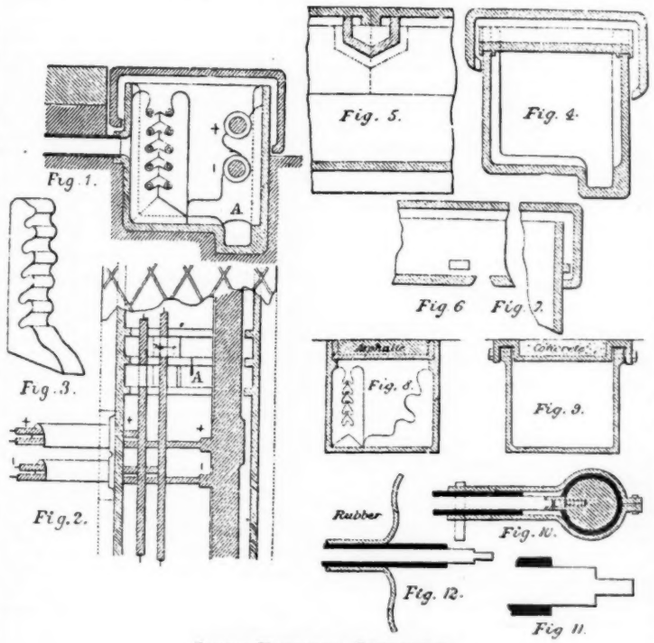
In a study of this new light Mr. Morin has observed a few phenomena resulting from the action of the solenoid upon the voltaic arc. Thus, in a chandelier in which the four candles were symmetrically arranged around the axis of the strip, *A*, two of them that were diametrically opposite, and situated above the free space comprised between the two halves of the solenoid, were not at all influenced; in the third, which was situated over the middle of one-half of the solenoid, the arc was slightly repulsed toward the extremity of the carbons, as in Jamin's apparatus; and, finally, in the fourth, the arc was driven toward the base, that is to say, against the supports, which would have been destroyed in a few instants.

These differences of action, which may be readily understood on considering the direction of the current in the arc and in the nearest portions of the solenoid, constituted a very grave defect, which Mr. Morin has remedied by removing the solenoid as far away as possible, and by interposing a strip of iron plate, which, according to him, gives a proof of the reality of magnetic screens.

For measuring the work absorbed by these candles, the inventor makes use of a continuously indicating dynamo-metric pulley, which he has constructed after the principle of his dynamometer. He finds from this that—

3	candles	absorb	3.30 H. P.
4	"	"	4.16 "
5	"	"	5.40 "

*From *La Lumiere Electrique.*



LAYING ELECTRICAL CONDUCTORS.

An English System of Laying Electrical Conductors.

We illustrate a mode of fixing electrical conductors which has lately been proposed by Mr. Henry F. Joel, of 44, Lavender Grove, Dalston, England. In this system the ordinary stone curbs of pavments would be replaced by cast-iron boxes made in 9 ft. lengths, and approximately of the form shown in Fig. 1, the width and depth of the space enclosed by the trough being about 10 in. In the bottom of the trough is formed a narrow gutter for taking off any water that may drip through, and as will be seen from the plan, Fig. 2, ribs are cast at intervals within the box to receive the insulating supports for the wires. On one side of the trough provision is made for attaching lengths of gas pipe to receive and lead to adjacent houses, such service conductors as may be required. The lengths of cast-iron trough are bolted together by flanged joints, with rubber packing pieces, and the covers overhang each side, as shown in Fig. 1; the upper surface of these may be formed with recesses, corrugations, or grooves to afford a foothold. At the ends the covers are made with flanges that butt against each other to form the joint, which is further protected by inner flanges so shaped as to form a gutter when joined together and receive and carry off any drip that may come through the joints. The covers are secured to the boxes by pins cast in the latter, which enter slots in the former (Figs. 6 and 7), locking plates being also added at intervals. In crossing over streets, the boxes and covers are made as shown in Figs. 8 and 9, the covers being sunk to receive asphalte or concrete. The conductors are carried by earthenware or glass brackets, Figs. 1, 2, 3, and 8. On the left hand of Fig. 1 the mode of placing these brackets is shown, and from this it will be seen that when in position they lock all the wires carried by them On the right-hand side is another bracket for conductors of a larger section. It will be observed that the foot of this bracket butts against the back of the other one, and holds it in place, but by slipping the right-hand bracket to one side, the others are released and can be easily removed. Figs. 10, 11, and 12 show clearly the method of connecting the service wires with the main conductors, Fig. 10 illustrating the joint complete.—*Engineering.*

How Time Tables are Made.

One of the most laborious things connected with the management of a railroad is the instituting of changes in the time-table governing the running of trains. Instead of it being done with pen and paper, as many may suppose, the entire running arrangement of all passenger and freight trains, their crossing of other tracks or passage of other trains, their stops, and lost time are all calculated by simple, common pins and spools of different colored threads. Before a time-table or schedule is prepared the time chart is first perfected. To prepare a time chart a large sheet of drawing paper is first stretched on a smooth surface and mounted on an easel. The chart is ruled either for two, five, or ten minute time by horizontal lines and perpendicular cross-lines. The "time" is marked above the horizontal line, and the distances, or stations and terminals, down the first perpendicular line. For illustration, 12 midnight is the mark on the first horizontal line, and each hour is marked until the twenty-fourth, or the following midnight hour, is reached on the last horizontal line. Between the hour lines the space is divided into minutes and graduated as fine as desired. On a two-minute chart the space between the hours is divided into 10 minutes' time and the 10 minutes' time into 2 minutes' time. The hour lines are made heavy and the lesser time lines are of a lighter shade to distinguish them The one terminus of the road, Milwaukee, for instance, is marked on the first line beside the first time mark, 12 midnight. The other stations follow down the perpendicular line until the other terminal is reached. Then all is ready to prepare for the running arrangement, provided the pins and thread are ready. A blue thread means a passenger train, a red thread a freight train, and if the trains of other roads use part of the track they are designated by a different colored thread. It is calculated that the running time shall be, say, 25 miles an hour, and for the purpose of illustration, the tracing of one passenger train will answer the purpose of explaining them all. A passenger train leaves Milwaukee at 8 A. M. A pin is placed on the horizontal line at the 8 A. M. time mark, and the end of the blue thread fastened thereto. If the train runs without stopping for fifty miles, the blue thread is stretched over opposite to the station at which the stop is made, and directly under the 10 A. M. time mark another pin is stuck, and the blue thread wrapped about it to keep it taut. If this is a stop, say, of 40 minutes, the blue thread is stretched to the 10:40 A. M. mark on a direct line with the same station, and another pin stuck and the blue thread wrapped. The train starts and its entire course is thus timed and distributed along the road. If the railroad has, say, 40 or 60 passenger and freight trains running daily, the time chart, when it is completed, looks like a great spider's web stretched out with pins. But little work then remains to transfer the time and stations to the time-table and the schedule is ready for the printer.

The Nickel Plate Patent.

The decision of the United States Court for this district, Judge Blatchford presiding, sustains once more, goes a little further, and gives a still broader interpretation to the Adams patent than had been given at any previous trial. Judge Blatchford holds substantially that Adams was the first discoverer of a practical method for electroplating with nickel, and his patent secures to him practically a broad monopoly of the art, and of all articles electroplated with nickel. The patent in question was granted to Isaac Adams, Jr., August 3, 1869, and the two principal claims read as follows:

1. The electro deposition of nickel by means of a solution of the double sulphate of nickel and ammonia, or a solution of the double chloride of nickel and ammonium, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime, or nitric acid, or from any acid or alkaline reaction.

4. The electroplating of metals with a coating of compact, coherent, tenacious, flexible nickel of sufficient thickness to protect the metal upon which the deposit is made from the action of corrosive agents with which the article may be brought in contact.

The defendant, Pendleton, obtained a patent September 28, 1880, for what he claims as a new and entirely different mode of plating with nickel. His claims are as follows:

1. In the art of nickel plating, an acid solution of acetate of nickel, consisting of oxide of nickel and acetic acid, said solution having an excess of acid.

2. The method of making acid solutions of acetate of nickel, consisting in slowly digesting oxide of nickel and acetic acid with or without heat, so as to have an excess of acid in the solution, substantially as described.

The court held the Pendleton process to be merely the chemical equivalent of the Adams process, and accordingly gave judgment for Adams, with injunction and an account. How the Supreme Court will look upon the matter remains to be ascertained.

The citizens of Geneva intend to utilize the flow of the Rhone to furnish power enough to give electric light to all of the city. The Council of State is to determine the matter at an early date. Much natural energy now being dissipated might thus be turned to profitable account in and near many other cities.

Telephonic.

The telephone system of Hermosillo, Mexico, is badly attended to.

The telephone line between Oaxaca and Ocotlan, Mexico, was inaugurated with great festivities on the 5th instant in both towns.

For the better service of the street-car lines there will be telephonic communication established between the suburban towns of Tacubaya, Mixcoac and San Angel, Mexico.

The telegraph line between Monterey and Saltillo was opened for business on the 25th ult.

Major F. B. Knight, Special Agent of the American Bell Telephone Company, having closed the Camp Meeting at Ocean Grove, is spending a week at Kingston-on-the-Hudson with his family.

Mr. Charles Haskins, Jr., Electrician and Secretary of the Wisconsin Telephone Co. is spending a week in New York, having just returned from a three weeks' visit to Nantasket and Newport.

Mr. E. T. Gilliland of the *Gilliland Electrical Works*, Indianapolis, has just returned from a European tour looking hearty and bright as of old.

The Buenos Ayres *Standard* says that there are more than 1,000 subscribers to the United Telephone Company of the River Plate, the administration and central offices of which, situated in the city of Buenos Ayres, constitute a fine building 50x200 feet. In addition to its telephonic service the company has a messenger service. Since April 10, when the company began operations, it is reported to have doubled in paying subscribers the combined lists of the old Pau and Bell companies, from which it was formed.

The Directors of the Western Union Telegraph Company have made a concession to their employes by issuing the following order on Tuesday:

"Commencing to-day, seven and a half hours' actual service in this office during week nights will constitute a day's work, or, in other words, the hours of the night force will be from 5:30 P. M. till 1.30 A. M., allowing thirty minutes for lunch. Sunday service will be paid for the same as other over-time services, at the rate of one-seventh of a day's pay for each hour. All payments for overtime, including Sunday service, or for a fractional part of a month, will be based upon the number of week days in the month."

Highway Robbery.

A CLEVER CAPTURE BY A BROOKLYN DISTRICT TELEGRAPH OFFICER.

Alexander Katz was driving through Atlantic avenue early last evening when he was accosted by three young men who asked him to treat. Katz consented, alighted from his wagon, and with the three men entered a saloon and took a drink. Returning to his wagon he drove off, but had gone only a short distance when one of the men seized the horse by the bridle, while the others clambered into the wagon, and while one struck him with a club the other stole $15 from him and grabbed at his watch, which he succeeded in securing after breaking the chain. A crowd gathered and the thieves took to their heels. Officer F. G. Jones, of the Brooklyn District telegraph police was signalled for by a subscriber who witnessed the affair from his residence, and the officer seeing the crowd following the three men grabbed two of them. One managed to escape from him, but he held on to the other and took him to the Tenth Precinct Station, where Katz accused him and his companions of assault and highway robbery. He gave his name as John W. Featherstone, and said he lived at 59 Willoughby street. Subsequently Officer Henagar arrested the other men. They are Thomas P. Ryan, of 105 Navy street, and Patrick Gannon, of 137 Hudson avenue. The trio were to-day committed by Justice Walsh pending an examination.

New Telegraph Scheme.

A COMPANY ORGANIZED TO BUILD LINES WITH MONEY YET TO BE RAISED.

BOSTON, Aug. 31.—One of the results of the recent strike of the telegraphers is the formation of a new company under the general laws of the State of New York. The name is "The Citizens' and Telegraphers' National Union Telegram and Cablegram Company." The capital stock is fixed at $5,000,000, with shares to be of the par value of $25 each, and no person to be permitted to hold more than $100,000 worth. There are to be thirteen trustees, of whom seven shall represent citizen and six telegrapher stockholders. Books for subscription will be opened on September 15th, and as soon as $200,000 has been subscribed lines will be built or purchased and operated, but no faster than the subscriptions to the stock shall provide means. Precautions will be taken to guard against any selling out of the company, and every employe and officer must be a stockholder. The corporators named in the document are Eugene J. O'Connor, Charles E. Chute, and Thomas W. Greene of Boston, and others.

The First Electric Telegraph.

The idea of the practical application of the electric telegraph to the transmission of message was first suggested by an anonymous correspondent of the *Scots Magazine*, in a letter dated Renfrew, Feb. 1, 1753, signed C. M., and entitled "An Expeditious Method of Conveying Intelligence." After very considerable trouble, Sir David Brewster identified the writer as Charles Morrison, a native of Greenock, who was bred a surgeon, and experimented so largely in science that he was regarded in Renfrew as a wizard, and eventually found it convenient to leave that town and settle in Virginia, where he died. Mr. Morrison sent an account of his experiments to Sir Hans Sloane, the President of the Royal Society, in addition to publishing them anonymously as stated above. The letter set forth a scheme by which a number of wires, equal to the letters of the alphabet, should be extended horizontally, parallel to one another, and about one inch apart, between two places. At every twenty yards they were to be carried on glass supports, and at each end they were to project six inches beyond the last support, and have sufficient strength and elasticity to recover their situation after having been brought into contact with an electric gun-barrel placed at right angles to their length about an inch below them. Close by the last supporting glass a ball was to be suspended from each wire, and at about a sixth or an eighth of an inch below the balls the letters of the alphabet were to be placed on bits of paper, or any substance light enough to rise to the electrified ball, and so continued that each might resume its proper place when dropped. With an apparatus thus constructed the conversation with the distant end of the wires was carried on by depressing successively the ends of the wires corresponding to the letters of the words, until they made contact with the electric gun barrel, when immediately the same characters would rise to the electrified balls at the far station. Another method consisted in the substitution of bells in place of the letters; these were sounded by the electric spark breaking against them. According to another plan the wires could be kept constantly charged and the signal sent by discharging them. Mr. Morrison's experiments did not extend over circuits longer than forty yards, but he had every confidence that the range of action could be greatly lengthened if due care were given to the insulation of the wires.—*Engineering.*

South American Telegraph Tolls.

MONTEVIDEO, Sept. 1.—The following tariffs have just been announced for telegrams over the Central Company's lines, via Galveston: Between all Uruguay and the United States, $3 a word; between all Uruguay and Europe, $2.71 per word.

Society of the Military Telegraph Corps.

CHICAGO, ILL., Aug. 10, 1883.

DEAR COMRADES,—At a meeting of the Society of the Military Telegraph Corps, held in Chicago, August 8, the following were elected members of the organization: Wm. Mackintosh, Providence, R. I.; W. J. Dealy, New York; Wm. L. Ives, New York; Thos. Dolan, New York; John H. Dwight, New York; Richmond Smith, New York; J. H. Emerick, New York; Joseph Knittle, New York; M. Gordon, Wheeling, W. Pa.; C. T. Mason, Sumter, S. C.; Fowler Bradnack, New York; E. C. Newton, Little Rock, Ark.; C. H. Spellman, Danville, Ill.; R. B. Griffin, Mexico, Mo; S. L. Griffin, Mexico, Mo.; Geo. Henderson, Newberne, N. C.; Chas. Lehr, Bremen, Ind.

The President, after obtaining the views of all members present, fixed upon the third Wednesday of September, 1883, as the time for the second annual reunion of the Military Telegraph Corps, to take place in Chicago. By authority of the society, the President, upon the advice of those present, appointed the following enlarged Committee on Transportation: John Thomas, Supt. B. & O. R. R., Chicago, Ill.; C. W. Jacques, Dispatcher C. & N. W. R. R., Chicago, Ill.; A. M. Nichols, Gen. Freight and Pass. Agent C. & W. M. R. R., Grand Rapids, Mich.; O. H. Dorrance, Supt. —— R. R., Wallace, Kansas; Jos. Hansen, Vice-Pres't D. L. & N. R. R., St. Joseph, Mo.; L. H. Korty, Supt. Telegraphs U. P. R. R., Omaha, Neb.; Isaac McMichael, Supt. W. U. Telegraph, St. Paul, Minn.; Solomon Palmer, Supt. Construction W. U. Telegraph, St. Louis, Mo.; J. N. Brooks, Pass. and Ticket Agt. L. & N. and G. S. S. & N. Ala. R. R., Nashville, Tenn.; O. H. Booth, Supt. Telegraphs, Mansfield, Ohio; S. J. Kelly, L. S. & M. S. R. R., Cleveland, Ohio; Philip Bruner, Supt. C. & P. R. R., Wellsville, Ohio; T. Q. Waterhouse, Traveling Passenger Agent, Bryan, O.; S. P. Peabody, O. & M. R. R., Cincinnati, O.; Wm. B. Wilson, Agent Pa. R. R., Lancaster, Pa.; C. D. Hammond, Supt. A. & S. R. R., Albany, N. Y.; Charles G. Eddy, Gen. Agt. Mo. Pac. R. R., New York City; George C. Maynard, Electrician, Washington, D. C.

Every committeeman's district includes all places nearer him than to any other member of the committee. If a committeeman is unable to obtain satisfactory transportation all the way, it is hoped he will solicit the aid of the next nearest on the route. The success of the reunion will be largely proportionate to the zeal of the committee, but it is expected that all members of the corps will feel the necessity of arranging their own transportation as far as possible, and thus relieve the committee to that extent.

The President also appointed L. D. Parker, Superintendent Postal Telegraph Company, formerly of the Department of the Tennessee; A. H. Bliss, commission merchant, of the Department of the Potomac, and E. P. Whitford, Manager W. U. Board of Trade office, of the Departments of Cumberland and the Gulf, as Committee of Arrangements, and all of the members present pledged themselves to assist the committee in any way they could. It is expected that the business meeting will begin, probably at the Grand Pacific Hotel, at 10 A. M., Wednesday, Sept. 19th; that the committee will arrange for a pleasure excursion on the lake, or carriage ride about the parks, in which the old-timers will join, and that a joint military and old-timers' banquet will occur in the evening. The annual old-timers' business meeting will begin at 10 A. M. the next day.

We expect to have the finest gathering of telegraphers that ever met in this country, and a right royal good time. The committee here will make the best possible arrangements with hotel proprietors and others, so that your expenses will be as small as practicable. Let me know as soon as possible about your coming, as it is highly important to advise the committee. Concerning Congressional action, the committee having that matter in charge deemed the wisest course to be to defer the matter to a new Congress and not present it to the short session overburdened with deferred matters.

I will take the present occasion to refresh your memory regarding your photograph for the society album.

The members of committees will please consider this an official notification of their appointments, and it is hoped they will put themselves in communication with kindred committees in the society of old-timers.

Yours fraternally,

J. E. PETTIT,
Secretary and Treasurer.

Care Mutual Union Telegraph Co., Chicago, Ill.

Extending Postal Telegraph Wires.

Contracts to the amount of $1,500,000 for the construction of new lines have been awarded by the Board of Trustees of the Postal Telegraph Company. Lines of two wires each will be put up from New York to Washington, New York to Boston, Buffalo to Pittsburgh, Fostoria, Ohio, to Toledo, and Chicago to St. Louis. Two wires will be added to the wires already strung between New York and Chicago. The lines are to be completed, according to the terms of the contracts, by January 1. The capacity of the copper wires now up between New York and Chicago is equal to twenty iron wires, and will be doubled by the additional two. John W. Mackey, the president, will leave here for California in a few days, but he will see the work fairly under way before he leaves. The contractors begin at once.

Asleep on the Telegraph Wires.

People have been known to sleep on housetops, in the branches of trees, and on rare occasions in a sleeping car, but probably the first case of any one selecting the top of a telegraph pole as a lodging place occurred Thursday night. Shortly after midnight Jack Donegan, one of the linemen employed by the telephone company, appeared, fully equipped in his working uniform, including climbers, at Wood Brothers' ice-house, at the foot of Holmes street, and asked the men in charge for the loan of a short piece of plank. Supposing that he wanted to use it in making some repairs of telephone lines, a large number of which pass directly in front of the ice-house, they gave him the plank, but were unprepared, by the surprise which awaited them, for Donegan, taking the board under his arm, climbed the top of a high pole near by, and laying the plank across the wires, cooly rolled up his coat for a pillow, and stretching himself on the plank, composed himself for a snooze, and was soon snoring as peacefully as a babe in its mother's arms. The employes of the ice-house expected to see him fall every moment, but were afraid to make any attempt to wake him lest it should frighten him and precipitate his tumble. About 4 o'clock yesterday morning Officer Harrington came along, and being made acquainted with the situation, yelled, at the high-minded individual roosting at the top of the pole, and endeavored to persude him to come down from his lofty perch. Donegan wakened up in good order, but failed to recognize Harrington's authority to order him to come down. Finding persuasion of no avail, the officer, not to be outdone, and being something of a climber himself, "shinned" up the pole, and by the application of a little force, brought his man safely down to terra firma, and once more Donegan was taken to the station and a few hours afterward arrainged in the police court and fined $5 for drunkenness. Donegan says sleeping on the top of telegraph poles is one of his favorite passtimes, and he is unable to see any reason why he should be disturbed in his repose.

The Society of the United States Military Telegraph Corps had fixed upon the 19th of September for its annual reunion to take place in Chicago. The Old Timers have theirs on the 20th. Members of both organizations will join on the 19th in their social entertainment, ending with a banquet in the evening. The business meeting of the military society will take place at 10 A. M. on the 19th, and that of the Old Timers at the same hour on the 20th.

Dr. Norvin Green Before the Senate Committee on Labor and Education—Interesting Testimony.

On Thursday last the greater part of the session of the U. S. Senate Sub-Committee on Labor and Education was taken up in listening to testimony of Dr. Norvin Green, President of the Western Union Telegraph Company. In answer to questions put by Senator Blair, the chairman of the committee, Dr. Green said that he had been President of the Western Union for several years, but had been connected with the company since 1866. Previous to that time he was connected with other companies. He had watched the growth of the telegraph systems in the United States since the first appropriation was made by Congress, in 1847, for the purpose of experiments with the Morse system. This appropriation amounted to $30,000. The first experiment was made in the laying of an underground wire from Baltimore to Washington. As the knowledge of insulation at that time was not advanced, the current of electricity was lost when the wire had been laid as far as Glensburg, through the imperfect rubber insulation. It would be troublesome at the present time, the witness said, to operate a wire underground at that distance. Whenever wires were put underground public service would suffer. A system of wires underground was possible, and it had been in existence to some extent abroad. Dr. Green had seen a statement that all the wires in London were laid underground. This was not so; he had observed a perfect network of wires from the windows of offices in that city. There was as much complaint of them there as in this city. The Government wires in the center of London were underground, but the poles began long before one got out of the city.

When Dr. Green entered upon active telegraph business, in 1854, the wires reached through to the Southwest. At this time only two or three companies had paid a dividend. The Western Union was organized in 1851 and began operating in 1853, and had absorbed sixty smaller companies in one way and another. Then the New York, Albany and Buffalo was paying a small dividend. The Magnetic Telegraph Company was paying 10 per cent dividends, and the Boston and New England also paid a few dividends. In the first few years they had lost money, and had been compelled to issue stock and bonds to pay their indebtedness. Soon after this time a number of small companies were started in the South and West. All were failures, and little money was realized by stockholders. The American Union picked up many of them, and the Western Union absorbed others. About 1855 telegraph companies began to make money. The cost of maintenance had been very great. Test offices were built at intervals of forty miles, and from these stations horses and wagons had to be sent out for repairs, as there were no railroads. The public at first did not appreciate the telegraph. Between 1854 and 1856 the combination of companies was most rapid, and with each combination the service was greatly improved. Messages could be sent to long distances by one company with less delay than by several companies. In 1866 the United States Telegraph Company, which, as an opposition company, had extended its lines to Salt Lake and the Northwest, was absorbed by the Western Union. Soon after the American Telegraph Company, which covered the South and New England States, was taken in by the Western Union. This completed the Western Union system in 1866 all through the United States. Its capital at that time was $41,061,000. That capitalization was large, and was not made upon the plant and property. It was a monopoly. "I do not now consider Western Union a monopoly," Dr. Green said. Its capital was like that of the Bell Telephone Company, which now had a market value of $20,000,000. This value was placed upon the patents. At that time Western Union had only 400 or 500 contracts with railroad companies, which were estimated as of great value. The capital of the Western Union in that year represented $600 per mile of wire. To-day its capital stock represented $200 per mile of wire. "This shows," said Dr. Green, "that instead of watering stock there has been a distillation of capital." The area of the plant had been widely extended. The extension of miles of poles had been five-fold since 1863. Some of the lines were duplicated. There were three lines to Boston. The miles of wire had increased in this time from 75,000 to 430,000. According to the last annual report of the company to June, 1882, the number of miles of poles was 131,000. During the past year the number hod increased to 150,000. The offices in the report were 12,068; this year's additions would make the number 13,500. The number of messages sent in 1882 was 38,000,000; this year, probably, the number would reach 43,000,000. In 1866, 5,000,000 messages were sent The receipts, or 1882 amounted to $17,114,165.92, and the expenses to $9,996.095. The next report, Dr. Green thought, would show the receipts to be $19,000,000, and the expenses $11,000,000. The profits in 1882 were $7,118,070. The plant had increased in quantity 90 per cent., and in quality had more than doubled. In the past five years the increase in the number of messages amounted to over 83 per cent.

The character of the service, Dr. Green said, had much improved. The public each year required a better service, and messages must be sent in much better time. The Western Union could do its service much cheaper if it followed the plan of the English Government telegraph system. The Western Union service was the best in the world.

According to the report of General Eckert the reported time of all messages between the Chicago Board of Trade and the New York Produce Exchange for several days in June had been as follows: June 1, 375 messages averaged 30 seconds; June 2, 258 messages averaged 22 seconds. From the Stock Exchange 2,459 messages averaged 1 minute 45 seconds. From the Broad street office 5,592 messages averaged 1 minute 44 seconds. To Boston the average was less than 1 minute per message. This was the time from the filing of the message at New York to the time it was ready for delivery in the other cities.

In England the tardiness of the system was most palpable everywhere. In London the service was good, as a separate wire was given to each office and a large number of operators were employed. The reason of the tardiness was because the employes did not have any interests at stake. The offices were open from 8 A. M. to 8 P. M. A few months ago in England there were only fourteen offices open all night. From 8 P. M. Saturday night to 8 A. M. Monday morning a man in London could not telegraph to Brighton.

According to statistics the time of a message from Antwerp or Paris to London averaged 2 hours; from Bremen to London 1 hour. In a week's time, taking in both night and day messages, the time was as follows between the cities named below:

From Rome to London, 27 messages, 2h. 43s.; from St. Petersburgh to London, 13 messages, 1h. 46s.; from Brussels to London, 7 messages, 1h. 10m.; from Berlin to London, 3 messages, 1h. 7m.; from Constantinople to London, 4h. per message. These messages averaged forty words.

The errors in this country were small in comparison with those of foreign telegraph systems. The tendency of the companies in Europe, the witness thought, was to retrograde. The average complaint of Western Union messages was 1 to 5,000 messages. One-half of those sent in Europe contained some bull, or some word that could not be understood. People made no complaints in England—as they knew it would do no good.

Speaking of the rates in this country as charged by the Western Union, Dr. Green said that the Western Union system was much the largest in the world. It was equal to those of Great Britain, France, Austria and Germany combined. For such long distances as existed in this country—and the Western Union had a line 4,500 miles long—he did not believe a uniform rate to be practicable. Within 100 miles of London and 100 miles of Liverpool nine-tenths of the business in England was done. In this country to Philadelphia only 15 cents was charged. Taking into account the long distance, it was the cheapest telegraph line in the world.

European prices are as follows: London to Austria, 700 miles, 9c. a word; London to France, 200 miles, 5c. a word; London to Germany, 500 miles, 6c. a word; London to Italy, 800 miles, 8c. a word. From New York to Boston was about as far as from London to Paris, yet the rate in the former case was only 25 cents. Messages averaged seventeen words.

Dr. Green did not know what the revenue of the British Government telegraph system amounted to. It was claimed that system paid expenses, although appropriations were made for the telegraph yearly. The Government leased many wires to newspapers. There were papers published in Manchester and Glasgow which were edited in London.

In regard to the capitalization of Western Union, Dr. Green said that the committee had received testimony that was not correct. From 1866 to 1881 there had been no increase in the capital stock of Western Union. When the Atlantic and Pacific was taken in not a dollar was added to the capital stock, as stated by a previous witness. It was leased at 4 per cent. on $2,000,000 of capital. In 1869 Dr. Green was absent from active duty in Western Union. In this time it was decided to suspend the dividends for four years. The revenues of this time were used in taking up the stock of the company. This amounted to $11,000,000. A part of this amount was afterward spent in getting control of the Cuba Cable Company and the Pacific and Atlantic Telegraph Company. Then a stock dividend was given, distributing the remainder in the treasury. This was done in 1878. That stock, the witness reiterated, was purchased with the earnings of the company. In 1881 the American Union was bought with $15,000,000 of stock. Afterward a distribution was made of the surplus in the treasury to the old stockholders who had gone without dividends that the earnings might be put in the plant. The original charter declared that the lines should be extended by issuing additional stock. The capital stock of Western Union to-day was $80,000,000. The money value of the plant, the witness said, it was difficult to estimate. "We do not think it is all property of the company. The company has many valuable franchises. Its patents are worth millions of dollars. Then we count in the value the good-will of the company and its earning capacity. The material property is not worth $80,000,000."

Senator Blair—What is it worth?

The Witness—I haven't the figures. The capital stock represents $200 per mile per wire, however, and I know of no company capitalized so low as that. The true estimate of the property of Western Union is derived from its previous capacity and good-will. On that basis it is worth $80,000,000. There are also franchises no other company could get. Many of its most valuable patents are not in use at present.

Senator Pugh asked about the wages of the operators and the expenses of the company. The expense, this year, the witness said, would be $11,000,000. Little over four-tenths of the expenses were for the services of agents of the company. The average wages that had been paid had been stated to the committee by witnesses much too low. According to the table of standard salaries the average paid operators was $70 per month. The witness had this table revised carefully since his return from Europe. Four-fifths of the employes had been promoted from messengers. The higher officers of the company were once office boys and messengers. The company had really paid its apprentices. It had run a free school in telegraphy. The Cooper Union school was run five months in the year and turned out 60 operators a year. In the table prepared there was no salary less than $30. No operator received less than that amount without being paid for something else. The table did not include higher officers, and not even the linemen. Some of the operators who worked in hotels received small salaries, but had their hotel bills paid. Others, messenger boys perhaps, would work for a short time during the week on the instruments. For this they got $10 or more. Taking in such small salaries, the average was $68 97. The table was made up from 40 principal offices. The average salary in all country and city offices together was $64.90. This table was, the witness believed, an under-estimate. In London, the witness said, there were three classes of operators. The average for male employes was $28.26; for female employes $18.36. The average of both was $24.20. The first class operator received £100 a year. After five years' service it was increased £5 a year. A second class operator received £70 a year, and after five years' service was entitled to a like increase. The third class received 12s. a week. A proposed new establishment of rates added a small amount to the present salaries. In many London offices the operator worked from 8 A. M. to 8 P M. The witness thought the American operator much brighter than the English operator, and he received twice as much money.

Senator Blair—A Wheatstone operator told us that the purchasing power of the salary of an English operator was equal to that of the Western Union operator.

A—I am sorry I do not find it so. The rents there, it is true, are much cheaper, also clothing, but provisions are not much less in price than here.

In small offices in England, Dr. Green said, girls were employed at small wages. Much of the increased work in this country came out of the increased facilities and organization.

Dr. Green said he was on the Continent when the strike began and did not know of the state of things until the operators had gone out. He was decided in the opinion that there was nothing to do after they had gone out but to beat the strike. If this had not been done there would have been no end of the demands of operators. He did not believe there was much of a grievance at the bottom of the strike. Many operators, it was true, worked hard, yet some had leisure. After 3 o'clock in the afternoon the heavy business slacked up. "I think," he said, "the main cause of the strike was the conviction on the part of telegraphers that they were so well united together and there were so few to fill their places that they could dictate to the company as to their salaries. I believe in dealing fairly, but we never could agree that they should dictate their salaries to us."

Senator Blair—The operators complain that their salaries were constantly being reduced, and universally the applications made for more pay were pigeon-holed.

A.—It is a great mistake. The fact is, a reduction was made after the panic of 1873. The President's salary was reduced 25 per cent.; all salaries of $5,000 were reduced 15 per cent.; all those receiving less than $1,200 submitted to a reduction of only per 5 cent. Since then the wages of the operators were increased and this loss made up. Thirty men last Monday were ordered an increase of salary. A slight reduction was made when the American Union was taken in This was on account of the salaries having risen too high through competition with the other companies.

Senator Blair—It has been stated that while salaries went down in the combination companies the tariff went up.

A.—That is not true. By competition sometimes rates got down low, and there was an increase, but at the same time the high rates to non-competing points were lowered. When the American Union was taken in the reduction of tariff was between 50 places. The general rate of telegraphy on our lines are lower than they ever were before. The operators, I think, now receive larger salaries in general than they have before, at least for any extended time. There was no regular scale of wages. In this table 256 operators are put down who receive $80 per month.

Female operators, the witness said, were capable, as a rule, of operating only short wires. Only five in the Western Union main office could operate heavy wires. They operate quadruplex wires to nine cities in Central New York. Female operators generally pursued telegraphy with no idea of promotion or remaining in the business. The highest salary paid a female operator was $70. They were as well paid for the work they did as the men. Senator Pugh asked as to the oath returning strikers had to take. The witness said that an agreement was drawn up to the effect that no association should control them in lieu of their employers. The first day after they came back an agreement was made that they must not belong to any secret association, but it was discarded in favor of the modifications.

Senator Pugh—Who holds the most of Western Union stock?

A.—Jay Gould.

Q.—Does he hold the controlling interest?

A.—No, sir.

There had never been a contest in the election of Directors, or in the meetings of the stockholders. The compensation of the officers was much larger in comparison than that of the operators. The Vice-President, a few years ago, was an operator at $50 per week, in the South. Now he receives $7,200.

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The Advantages of Theoretical Instruction.

Scientific progress in America has certainly been very encouraging during the past decade, and when it is remembered that mechanics and artisans have little opportunity here to obtain instruction in the theory of their several trades, but must needs learn them by rule of thumb, this progress is the more remarkable. Let it not be supposed that invention comes only from the liberally educated. This is by no means the case. The most important benefits to manufacture, if not to science, have come from those who received but little education save what they picked up themselves. In electrical science in America, this is notoriously the case; one of the foremost electricians having been a telegraph operator, and another an assistant in a laboratory.

When, however, we recall the work which practical mechanics have done in the workshop, we cannot help thinking how much more might have been accomplished had these men and their fellow-workmen been schooled in the theory as well as the practice of their several trades.

The philosopher, we have been told, may very justly be delighted with the extent of his views, and the artificer with the readiness of his hands; but the one should remember that without mechanical performances refined speculation is an empty dream, and the other, that, without theoretical reasoning, dexterity is little more than a brute instinct. So true is this, that many, no doubt the majority of mechanics, are in the habit of doing work as they have seen it done, never stopping to think of why a certain result is produced from a certain given premise, and not knowing the natural laws which apply to their several vocations, probably frequently witness phenomena which, if understood, would lead to the most important results.

The idea we have in view, is the organization of a school where he who is to be the future mechanic may take in the principles and theories of his trade at the same time he is learning to read and write.

The continental system of industrial schools does not fill this want. Why? Because a lad may not enter until he is at least sixteen, and the short course to which he must necessarily be restricted, since he must so soon begin to earn his bread, is entirely inadequate. And besides, being called upon to choose a trade before he knows himself which will best suit him, which he is best adapted to, it is ten to one he is graduated as a carpenter, when in reality he is best fitted by nature for a decorator, and thus when it is too late to change, he is thrust into the world as an indifferent carpenter, whereas he would have made an expert decorator or machinist.

In the school we have in our mind's eye, a boy should, at the earliest possible age, be trained in the use of tools of all kinds, and it would be an easy matter to discover before many years had been passed the particular trade for which he was best fitted.

The course of instruction should be somewhat flexible. But the flexibility should have reference to the forms and uses of the pieces made, rather than the sequence of the operation. It would need, therefore, a man at the head to contrive all the time what particular forms could be made most advantageously from year to year, and what intercalations are most suitable. The sizes should be varied, if nothing else. In general, we might say that the lessons should go in something like this order: In carpentry, lining and split-sawing a rough board; planing the rough board; sawing squaring, and fitting to lap corner-box, putting on cover, hinging and hooking; dove-tailing, splicing, dove-tailing corners; blind dove-tailing, mortising (various forms), framing, truss-making, paneling, stair-making.

In blacksmithing: making fire, round bends; drawing out; square bends; square bend with thickened angle; splitting and turning; twisting; forging round to square, square to round, and round to prismatic; welding; punching; riveting; upsetting; heading rivets and nails; making bolts and nuts; cutting threads by hand; drilling by hand; hinging; drawing steel; tempering steel; case hardening iron; welding steel to steel; welding steel to iron.

In turning: centering, turning, cylindrical form, taper round groove, head, square shoulder, tapering shoulder, use of chucks and face plates; turning cups, square screw thread, angular screw thread; angular thread nut; square thread nut; turning flanges; fitting shaft couplings.

In foundry work: molding square-block angle wire; flat wire; molding cylinder cone pieces of irregular outline; melting iron; tapping into ladle; pouring; molding pulleys; molding grooved pulleys; core-making; casting with simple round wires; casting with irregular wire; pickling and cleaning.

Then should follow: mold with sweeps; molding for brass; melting in crucibles and castings in brass; making alloys; making iron castings malleable; filing, chipping, and turning in wood.

This is but a small part of the work that should be done; but a small portion of the instruments which should be brought into play, but we give it only to indicate where the beginning should be made.

But above all, no work should be performed without explanations of theory being given and required.

Immediately after a child has passed the destructive age, the age in which he breaks things in order to see what makes them go, he enters upon a period devoted to attempts to construct something. This is the time to begin the instruction of the young mechanic, to school his mind while at the same time directing his hands.

What toil and heart-burnings might have been prevented if those whom we have recently seen discomfitted had been so instructed when young! Such an education would have shown them when but just beginning their search that they were looking for that which is not, or for that which the interposition of a natural law prevented them from finding at least, in the manner they had proposed to themselves.

A Melancholy Survey of American Science.

Under the title of "A Plea for Pure Science," Prof. Rowland of Baltimore addressed the recent meeting of the American Association for the Advancement of Science.

The professor is inclined to take a somewhat gloomy view of American scientific work, and those who read his arraignment of American professors, universities, colleges, and inventors, will wonder that he can remain in a country for which there seems to be so little hope from a scientific standpoint, and that, since he considers the work of English scientists so immeasurably superior to that done in his native country, he has not long since become an Englishman, and left us to ponder in silence over our own inferiority. We should, of course, miss him for a while, but possibly time, which makes all things even, would gradually accustom us to his absence.

Seriously speaking, Professor Rowland makes the common mistake of expecting to find in what might be called a new country the same development as that which obtains in the countries of the old world. Why cannot we grow wine in this country equal in flavor and bouquet to those of France? Is it because we have not the proper climate? Not at all. We have all climates, and possess all the conditions which go to make good wine. But wine culture is young here, and that development and cultivation of the grape to be found in the old-world vineyards has not yet been attained. So it is with pure science, which is not the growth of a day, but of centuries. The French, for instance, are naturally artistic, and the Germans musical. Is this the growth of a century? By no means. The ancestors of the one for centuries back were interested in the fine arts, and those of the other in music.

It may be said of Prof. Rowland that he sets before us an image, and then deliberately knocks it down again. He says that the American scientist is after gain all the time, and then later on he tells us that "in a new country the necessities of life must be attended to first."

Here is the way our Baltimore scientist alludes to his countrymen, not to say his fellow-workmen, in the somewhat flowery introduction to his address:

"Fain would I speak pleasant words to you on this subject. [The subject of the discourse.] Fain would I recount to you the progress made in this subject by my countrymen, and their noble efforts to understand the order of the universe. But I go out to gather the grain ripe to the harvest, and I find only tares. Here and there a noble head of grain rises above the weeds; but so few are they that I find the majority of my countrymen know them not, but think that they have a waving forest, while it is only one of weeds after all."

Then he goes on to say that Americans are in the habit of stealing the inventions of great men of the past for money-getting purposes, and, since he has inferred that Americans have no original ideas and the old country scientists have, it would seem but a reasonable inference that the inventions are filched from the latter.

This is a hazardous assertion, and we are of the opinion that Prof. Rowland would find no little difficulty in proving the charge. Indeed, he would not be a bold man who should guarantee to name two such appropriations of original ideas by the English and French—especially among the former—for every one the learned Baltimorian shall discover on this side of the water.

Nor does it seem in very good taste for Prof. Rowland, who, so far as we know, has not added to any very great extent to the world's knowledge, to thus seek to asperse and belittle his fellow-workmen who have.

Among these are men who, though to use his own words, "possessed the necessary element of vulgarity" to labor at applied science, have nevertheless done that which not only benefits their fellow-men, but will, there is little doubt, be remembered with gratitude by the generations that are to come.

We think, too, that there will be found many eminent scientists even in England, which may be called Prof. Rowland's scientific Utopia, who will be candid and generous enough to deny the professor's proposition that little work of a purely scientific nature is done in America. If the published reports of lectures delivered in Great Britain and on the Continent may be relied upon, the best scientific minds of England, France, and Germany are wont to quote liberally from the opinions of American scientific thinkers.

Aside from those parts of the address to which we have referred, there is much that is interesting, notably that portion devoted to American colleges and the work done therein, and it is to be regretted that what might have been an interesting and instructive discourse should be marred by the introduction of that which smacks of bad taste, ill manners and dudeism.

The Abandonment of the Telephone Consolidation.

In regard to the failure of the proposed telephone consolidation, the Hartford *Courier* says that probably no formal action in regard to the matter will be taken, as it was left with the Executive Committees to use their discretion in completing the union proposed. The pronounced opposition of the Providence company was not without its influence on the Connecticut people, and the Lowell managers were scarcely prepared to say that they would take the whole concern and work it. There has been a good deal of mental wear and tear in getting the proposed compact into shape, and during the time negotiations were going on the managers were obliged to suspend their active work of development. But all is changed now, and proceeding on the assumption which is almost a certainty that a New England union is a long time in the future, they have taken hold of the accumulated work with their well-known zeal and tireless activity. A good many plans for the improvement and extension of the Lowell properties, which were under consideration before consolidation was proposed will now be completed and carrying them into execution will be actively pushed.

Electrical Notes.

Thousands of pens are constantly busy heralding the benefits which are being conferred upon the world by science; but though every one knows that science is also the cause of much mischief, no one seems to have set himself the task of pointing it out.

***

The educated cracksman, or, perhaps, we might use the term scientist cracksman, is far more dangerous than his even Christian from the slums.

***

His is no bungling, awkward work. He knows all about metals, their composition, resistance to force; he understands the power and constituents of explosives; he does not need to look at the builders to learn how their work is done, for theoretically he knows more about it than they do.

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As may easily be seen, all this makes the scientific criminal far more dangerous to the community than the uneducated criminal.

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Again, until chemistry came to be a popular study, the poorest man might eat his food with the assurance that it contained nothing deleterious to health.

***

Now, all this is changed. The scientist is required in the manufacture of many kinds of food—that is to say, he is called upon to perform a certain work, and certainly no one will accuse us of a cynical asperity if we assert that this work frequently consists in adulterating food products.

***

Quite recently we saw one of the largest provision houses, or rather, pork-packing establishments, in Chicago, publicly accused of adulterating their lard to an almost unlimited extent.

***

Up to quite recently the markets of the world have been flooded with spurious, if not poisonous teas, which are made from a plant resembling the tea plant only in shape, and coffee is being made in large quantities of a species of meal—baked, browned and moulded. Sugars contain rice flower; and many candies are made from glucose altogether.

***

Of all the shams and frauds that are boldly palmed off upon a long-suffering public, this glucose business is the shallowest and the meanest. Not because it is poisonous, for this is not necessarily the case.

***

It is a product of corn; a bushel of this worth twenty cents, making a dollar's worth of glucose, and when properly prepared is not at all poisonous.

***

But its use, as we said before, constitutes the meanest of all frauds, because when the brewery cheats, and the grocery and confectionery swindlers are caught in the act of using it, they will whiningly declare that glucose is not poisonous.

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As if it was of any consequence to a man who had found marble dust in his sugar, to be told that marble dust was not unhealthy.

***

What did he ask for and what did he pay for? That's the question. If he asked for marble dust and only paid for marble dust, or if when he wished some candy for his children he demanded and paid for glucose, then the business is a legitimate one.

***

Otherwise it is a sham and a cheat, and no man with one particle of honor in his composition would engage in it.

***

But probably in no other part of the world's market does the scientific swindler play so important a part as in the wine industry. France may safely be said to fairly reek with chemically prepared, fortified, loaded and otherwise doctored wines and brandies.

***

Thanks to the phylloxera, the vineyards have as good as failed, and were it not for unscrupulous chemists little French wine and no brandy would reach this country at all.

***

In other words, of all the wines and brandies which come here from France, few of the former are genuine and none of the latter. We do not say this on our own authority, but upon that of Consul Gifford, of Bordeaux: the chief port whence wine and brandy is shipped hither.

***

He says that no brandy is grown now at Cogniac, and none of that grown in the other wine districts comes to this country. Notwithstanding this, large quantities of so called brandy is constantly arriving here with the French customs mark thereon.

***

Consul Gifford says that these are poisonous and should not be permitted to land.

***

He says that when you see upon these bottles such legends as "Old Brandy, 1864," "Fine Old Brandy, 1868," you may know that the liquid contained therein has been made to as nearly as possible imitate in taste and color the brandies put up in those years.

***

As to the wines, he says that upon the outskirts of Paris are innumerable manufactories where they are made from rotten apples, spoiled dry fruits, raisins and the like.

***

Nor is pure alcohol used in imitating the various descriptions of wine. By no means. The cheap German alcohol, which is made from potatoes, is used almost exclusively.

***

Not long ago a commission, appointed by the French Government to report upon champagne culture, declared that only one-ninth of the champagne demanded of France could be produced; that is, the French vineyards were not capable of producing more than one-ninth of that demanded of them.

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Now, since we have not heard of any orders sent to France for champagne having been returned unsatisfied, we may not illogically conclude that eight-ninths of the champagne sent out of France is made from something else but the grape.

***

Fortunately, a traveler in the Low Countries, Holland especially, comes to our rescue. He says while making a tour through the agricultural districts recently, he was surprised at the immense turnip tracts that greeted the eye on every hand.

***

At first it seemed to him as though a turnip mania was about to succeed the tulip mania; but a little inquiry discovered the fact that the expressed juice of this vegetable was sent to France, there to be made into champagne.

***

Let the ingenious Yankee hereafter hide his head in shame.

***

Verily, he is outdone by the French.

"Do men gather figs from thistles?" the Bible asks us. Certainly, if this sort of thing continues, it will not be at all surprising in the near future to see them succeed in doing this.

***

Only a few examples have been given of the mischief which has been wrought by unscrupulous scientists. These, however, will suffice to show that it is only when scientific endeavor is directed toward legitimate goals, that its development constitutes a blessing.

The decision handed down on Friday last by Judge Blatchford, as Circuit Judge of the Southern District of New York, in the action of the Gramme Electrical Company against the Arnoux & Hochh usen Electrical Company, which was brought in equity for the infringement of letters patent granted to Zenobe Theophile Gramme and Eardley Louis Charles D'Ivernois, October 17, 1871, for seventeen years from that day, for an "improvement in magneto-electric machines," is of vast importance to all of the electric light companies in this country using the arc system, for all of them use dynamo machines based on that of Gramme, and have hitherto, to a certain extent, acknowledged the right of the Gramme Company to collect royalties. What is known as the Gramme Company is composed of a number of electric light companies, who for mutual protection associate together and agree to prosecute infringements upon patents held by any one of the different companies. Most of these companies use the Gramme machine, but some of them, such as the Edison Company, only employ some of the minor devices covered by Gramme's patent. Messrs. Arnoux & Hochhausen, against whom the present suit for infringement was brought by the Gramme Company, are manufacturers of dynamo machines for various purposes—electric lighting, electro-plating, etc. They have always refused to acknowledge the validity of the Gramme patent, while following the same system. The present suit was looked upon as a test suit, upon the result of which depended whether or not the makers of dynamo machines of the Gramme type would have to pay tribute to the Gramme Company. There are two types of dynamo machines in the market, that of Gramme and that of Siemens. For certain reasons the Gramme machine is preferred to the Siemens for many purposes, and so long as the patent rights were undecided Gramme machines were most commonly manufactured. Arnoux & Hochhausen, having made a great deal of money in the business of making Gramme machines, resolved to contest the right of the Gramme Company to collect a royalty. The ground they took, and that upon which the suit has now been decided in their favor, is that Gramme's Austrian patent expired in 1880, and that under the United States law the American patent for the same invention expired at the same time.

Under the Austrian patent law an inventor for a small fee can obtain a patent running one year. If the patent proves to be of value he can renew it at the end of the year for any term within the fifteen years' life granted to Austrian patents. If the inventor fails to renew the patent fee from year to year, the patent lapses.

This is what happened in the case of the Gramme patent. The inventors obtained an Austrian patent in 1870, and paid the fees from 1870 to 1880, when they ceased doing so, and the patent lapsed. As this original failure affects all subsequent American patents, Judge Blatchford holds that the Gramme patent is worthless.

Major Eaton, the President of the Edison Electric Light Company, who may be considered a disinterested person, inasmuch as his company does not use the Gramme patent, was asked as to the importance of Judge Blatchford's decision.

"I had not expected that Judge Blatchford would decide against the Gramme Company, for the reason that the equity in the case is plainly on the side of the company which purchased from Gramme the right to use a certain invention in America. There is no question but that the company bought in good faith a valuable invention which they have introduced. The American patents which they purchased have yet several years to run, during which the profits would doubtless have been considerable. In equity it seems that some means of protecting the company in the enjoyment of its property should have been discovered. Judge Blatchford has decided the case purely on its technical merits. The Gramme Company will now carry the case to the United States Supreme Court. If Judge Blatchford's decision is sustained, the business of making Gramme machines will be thrown open to the public."

Electricity and Physiology.

The London *Electrician* says that in these days, when electricity is largely used as a curative agent—when it is suggested that it should be used as a punative agent—it is well to keep in view the experimental work that has been accomplished and the results obtained by the employment of electricity in physiological researches. These results are given in a most compendious form in Prof. Barker's address on resigning the presidential chair of the American Association for the Advancement of Science. This address was entitled "Some Modern Aspects of the Life Question," and will be found in Part I., Vol. XXIX. of the Proceedings. The following extract is taken from the address:

As a first result of recent work, the living organism has been brought absolutely within the action of the law of the conservation of energy. Whether it be plant or animal, the whole of its energy must come from without itself, being either absorbed directly or stored up in the food. An animal, like a machine, only transforms its edergy. Lavoisier's guinea pig placed in the calorimeter gave as accurate a heat-return for the energy it had absorbed in its food as any thermic engine would have done. But the parallel goes further. The mechanical work of an engine is measured by the loss of its heat, and not of its substance. So the mechanical or intellectual work of a living being is measured by the amount of carbon rather than the amount of nitrogen which is excreted. The energy evolved daily by the human body would raise it to a height of about six miles.

But, besides heat, work may be the outcome of the organism, and this through the agency of the muscles. Their absolute obedience to mechanical law in their mode of action has been admirably established by Hanghton. The work a muscle does it does in contracting. It is to the mechanism of muscle contraction that we are indebted for another illustration of our subject. When work is done by a muscle in contracting, three changes are observed to take place normally in its tissue. First, there is a loss of its electric tension; second, there is an evolution of heat in it; and third, carbon dioxide appears there, and its reaction, before neutral, becomes acid.

Matteucci was the first to observe and to call attention to the remarkable similarity in structure and in the mechanism of operation between striated muscular fibre and the electric organ of certain fishes. Recently, Marey has repeated and extended his observations. In structure, the electric organ is made up, like the muscle, of columnar masses, each separable transversely into vesicular sections. In a torpedo weighing seventy-three pounds, there were 1,182 of these columns in each of the two organs, with 150 sections, on an average, in each column. In the muscles which bend the forearm there are 798,000 fibrillæ. As to the mechanism, alike in muscle and in electric organ, an electric current stimulates action on opening and on closing the circuit, but not when it is flowing; the same phenomena take place in both with the direct and with the inverse current; both are reflex; stimulation of the electric nerve produces discharge, as that of the motor nerve causes muscular shock; an entire paralysis follows nerve-section; curare paralyses both; and tetanus results in both from rapid currents or from strychnine.

Still more striking analogies are furnished by the investigation of the susurrus, or muscular sound, first noticed in 1809 by Wollaston. This sound is produced by all muscles when in the state of contraction, the pitch of the note being not far from thirty vibrations per second. It is evidently only the intermittent contraction of the muscular fiber. A single excitation produces a muscular shock. As this production requires from eight to ten-hundredths of a second, it is evident that if another stimulus be applied before the first

has disappeared the two will coalesce; and when twenty per cent. reach the muscle, it becomes permanently contracted or tetanized. By means of a very sensitive myograph, Marey has found that in voluntary contraction the motor nerves are the seats of successive acts, each of which produces an excitation of the muscle. In 1877, Marey examined similarly the discharge of the torpedo, and found a most complete correspondence between it and muscular contraction. Since electric tension disappears from a muscle during contraction, does not the analogy suggest strongly that, like the discharge of the electric organ of the torpedo, muscular contraction is an electrical phenomenon?

Granting electric discharge to be a necessary concomitant of muscle contraction, what is the origin of this electricity? That it is not carried to the muscle by the nerves follows from the fact that a muscle will still contract when deprived of all its nerve fibers, or when these are paralyzed by curare. It must therefore be generated within the muscle itself. To reach a solution of the problem we must obviously follow the analogies of its production elsewhere.

Perhaps no single question in physics has been more keenly discussed than this one of the origin of electric charge. The memorable conflict between Galvani and Volta, between animal electricity and the electricity of metallic contact, succeeded by the even more triumphant overthrow of the latter and the establishment ultimately by Faraday of the electro-chemical theory—these are facts fresh in all our memories. The justice of time, however, in this case, if it has been tardy, has been none the less sure. The experiments of Thomson have vindicated Volta, and established the contact theory as a *vera causa*. And, more curiously still, it now appears to be proved that both contact and chemical action underlie the production of that very animal electricity so stoutly battled for by Galvani and his associates.

Volta's experiments to prove that a difference of potential is developed by the contact of two heterogeneous metals were not crucial. But Thomson, repeating them with the aid of more delicate apparatus, has shown that whenever copper and zinc are brought in contact the copper becomes negative to the zinc. In proof that the chemical action of atmospheric moisture was not the cause of the phenomenon, he showed that when a drop of water served to connect the copper and the zinc, no charge at all was produced. The fact may therefore be regarded as established, as the result of numerous and varied experiments, that a difference of electrical potential is always developed at the surfaces of contact of heterogeneous media. Not only is this true of solids in contact with solids, but also of solids in contact with liquids, and of liquids in contact with each other. Of course, the production of electricity by contact must result from a loss of energy elsewhere. In the opinion of Cumming, it is the loss of energy which is owing to the unsymmetrical swinging of the molecules on the two sides of the surfaces of contact which reappears as difference of potential between the solids or as the energy of electrical separation.

But we may carry the sequence yet another step backward. The energy which is thus lost at the surface of separation must be heat, and this junction must be cooled thereby. Thus the production of thermo-electricity is seen only to be a special case of a general law, a view to which the well-known Peltier effect gives support. In this phenomenon, when two metals are joined together in the form of a ring and one junction is heated, a current is produced which cools the other junction. From a study of these conditions, Thomson has concluded that the absorption of heat in a thermo-electric circuit varies for different metals with the direction of the current. Thus in iron the current from hot to cold absorbs heat, while in copper the current which absorbs heat is from cold to hot. In entire accordance with these results are the conclusions recently reached by Hoorweg. Whenever two conductors come into contact, motion of heat results in the development of electricity, the current produced existing at the cost of heat at one part of the point of contact, and evolving heat at the other for a result. Hence, all voltaic currents are thermo-currents.

To return to the muscle. it must now be apparent that the electrical charge which appears in its fibre may have its origin in so purely a physical cause as the contact of the heterogeneous substances of which the tissue is built up; the maintenance of this charge being effected by chemical changes going on constantly in the substance of the muscle, by which the carbon dioxide is produced, which is shown to be a measure of the work done.

Conceding, then, that a muscular contraction is conditioned upon an electric discharge, by what mechanism is the contraction effected? Prevost and Dumas supposed each particle of a muscular fibril to be magnetic. Such a row of particles would, indeed, attract each other when magnetized, and shorten the length of the whole fibril. But the force of contraction would increase as the length diminished; whereas the fact in the case of the muscle is precisely the reverse. Hence Matteucci supposed that electrification of the muscular fibre produces a repulsion between its elements, the subsequent return of this fibre in virtue of its proper elasticity constituting the muscular contraction. Radcliffe's theory is of more recent date and is somewhat analagous. He maintains that each fibre of the muscle together with its sheaf constitutes a condenser. When charged, the attraction of the two electricities compresses the fibre laterally and thus elongates it. When discharge takes place the normal elasticity of the fibre produces the contraction. Assuming, however, that the electrical phenomena take place during the latent period only, other theories of muscular contraction regard these phenomena as simply preparatory, the contraction itself being mechanical. Thus Marez likens the muscular fibre to a string of India-rubber, which, when stretched, contracts upon warming it; thus transforming heat directly into work. Rouget contends that the muscular fibre is a true spiral spring, which, actively distended during the repose of the muscle, returns upon itself at the moment of contraction; muscular contractility being thus a purely physical property of elasticity. Englemann, observing that during contraction changes take place in the doubly-refracting power of the alternate discs of the fibril, supposes muscular contraction to result from a passage of water from the isotropic layers into the anisotropic or doubly-refracting ones, thus osmotically increasing the volume of the latter. By this means the ellipsoidal doubly-refracting particles are converted into spherical ones; and, since the longer axes of the ellipsoids are parallel to the length of the fibre, the muscle is thereby shortened.

From this brief review does it not seem probable that the phenomenon of muscular contraction may be satisfactorily accounted for without the assumption of "vital irritability" so long invoked?

May it not be conceded that the theory that muscular force has a purely physical origin is at least as probable as the vital theory?

Time would fail me to discuss the many other phenomena of the living body which have been found on investigation to be non-vital. Digestion, which Prout said it was impossible to believe was chemical, is now known to take place without the body as well as within it, and to result from non-vital ferments. Absorption is osmotic, and its selective power resides in the structure of the membrane and the diffusibility of the solution. Respiration is a purely chemical function. Oxyhæmoglobin is formed wherever hæmoglobin and oxygen come in contact, and the carbon dioxide of the serum exchanges with the oxygen of the air according to the law of gaseous diffusion. Circulation is the result of muscular effort both in the heart and the capillaries, and the flow which takes place is a simple hydraulic operation. Even coagulation, so tenaciously regarded as a vital process, has been shown to be purely chemical.

Upon the hypothesis of Schmidt it results from the union of two proteids, fibrinogen and fibrinoplastic substance.

According to the later theory of Hammarsten, fibrin is produced from fibrinogen by the action of a special ferment.

There is another function which should by no means be omitted from our consideration. This function is that of the nervous system.

In structure this system is known to us all. In composition it is made up essentially of a single substance, discovered by Liebreich, and called protagon, the specific characters of which have lately been confirmed by Gamgee. In function the nerve cell and the nerve fibre are occupied solely in the production, the reception and the transmission of energy, which is believed to be electrical.

There is evidently a close analogy between the nerve and the muscle, the nerve fibre, like the fibrilla, being composed of cells, and having a positive electric charge upon the exterior surface, the tension of which is $\frac{1}{10}$th of a volt.

Indeed, a piece of nerve removed from the body exhibits nearly the same electric phenomena as a piece of muscle. Haughton attributes *tinnitus aurium* to the vibration of nerve cells.

The main objection raised to the electrical character of nerve energy is based upon its slow propagation. Though 36 years ago Johannes Müller predicted that the velocity of nerve transmission never could be measured, yet Helmholtz accomplished the feat very soon afterward. His results, like those of subsequent experimenters, show that the velocity of propagation of the nervous influence along a nerve, like that of electric transmission, is only about 26 to 29 meters in a second.

But it should be borne in mind, as Lovering pointed out, that electricity has no velocity in any proper sense. That since the appearance of an electrical disturbance at the end of a conductor depends upon the production of a charge, the time of this appearance will be a joint function of the electrostatic capacity of the conductor and of its resistance. Since each of these values is directly proportional to length, it follows that the time of transmission will vary as the square of the length of the conductor.

While, therefore, in Wheatstone's experiment, he found that electricity required rather more than one-millionth of a second to pass through one-quarter of a mile of wire, it does not follow that it would traverse 288,000 miles in one second, as he assumed. Indeed, as Lovering has shown, its actual velocity would be only 268 miles in an entire second. Hence the marvelous discrepancies which have been observed in the results of experiments made to determine the velocity of electricity on long wires are explained.

In the nerve itself, therefore, the velocity of transmission may be supposed to be the less as its resistance is greater. Now, Weber has shown that animal tissues in general have a conductivity only one fifty-millionth of that of copper, and Radcliffe found that a single inch of the sciatic nerve of a frog measured 40,000 ohms; a resistance eight times that of the Atlantic cable. In experimenting to confirm the above law of velocity, Gaugain measured the time of transmission of the electric current through a cotton thread 1.65 meter long, and found it to be 11 seconds. Two similar threads placed consecutively, thus forming a conductor twice as long, required 44 seconds for the passage of the current; or four times as long. From these data the apparent velocity in the short thread is at the rate of only 0.15 meter in one second; and in the long one only about half this rate, of course. The real velocity in both cases is the same, 0.5 meter per second. Hence the fact that the energy of nerve moves at the rate of only 28 meters per second is really no proof that it is not electricity.

But even if it shall appear that the nervous energy is not electrical, the argument is not weakened, since on no theory yet proposed is it assumed to be vital. Du Bois Reymond, while maintaining that "it would be rash entirely to dismiss the notion of electricity, being concerned, and even playing an important part, in the internal mechanism of the nerves," yet, assuming its low velocity to be fatal to its electrical character, suggests that the nervous agent "is some internal motion, perhaps even some chemical change of the substance itself, contained in the nerve tubes, spreading along the tubes both ways from any point where the equilibrium has been disturbed." And Spencer has advanced the view that "a nervous disturbance travels as a wave of molecular change," that "a nervous discharge is a wave of isomeric transformation."

The *Manufacturers' Gazette* says the use of storage batteries was put to a practical test at the Willimantic Mills, Willimantic, Conn., Monday night, in the presence of representatives of the various electric lighting companies. The plant was of the Brush-Swan system, and the current of two hundred and forty Swan incandescent lamps was operated from four Brush storage batteries of twenty-one cells each. The card-room was a special object of interest to mill representatives, and visitors expressed their surprise at the perfectly steady burning of each lamp. The advantage of the light in matching colors was shown by placing under it satin ribbon of different colors. Electricians who were present could hardly realize, until they had examined personally, that the dynamo was not in operation during the illumination, the whole current being furnished directly by the storage batteries. The managers claim numerous advantages in being able to store up electricity, in the quality and steadiness of the light and the utilizing of power that would otherwise go to waste in factories, and they believe that it marks an entirely new stage in the modern utilization of electricity for light and for use in motors.

The experience of Great Britian is strongly urged in behalf of the embarkation of the United States in telegraphy. In 1870 the British Government came into full possession of the telegraphic service of the country, and in 1874 it adopted a uniform rate of 1s. (or 25c.) for all messages under twenty words, combining addresses and signatures. The revenue and expenditures have increased as follows:

In 1873, revenue, £976,066; expenditures, £841,766; 1882, revenue, £1,616,799; expenditures, £1,366,000.

In 1879 the British telegraph service transmitted 23,385,000 messages; in the same year the Western Union handled 25,070,000 messages. The British service had at that time 6,600 offices, combining all the railway stations, while the Western Union had 8,534 offices. The Western Union in 1882 transmitted 39,000,000 messages and had 12,050 offices. The Western Union extends over more miles of line, that is of distance from point to point, than the British service has miles of wires. The Western Union extends over 137,000 miles and has 347,000 miles of wires. The revenue of the British telegraph office in 1882 was $8,084,000; that of the Western Union $17,114,000, or just about double.

W. S. Chapman, treasurer of the old timer's association, has issued the following, from his office, No. 110 Le Salle street, Chicago: "At the annual meeting of the association at Niagara Falls last year, the annual dues of members was fixed at one dollar. This amount is, therefore, now due from each member, and you are earnestly requested to remit the same upon receipt of this notice. It is expected that we shall have a large attendance at the annual reunion here next month."

The output of metals in the United States from January 1, 1882, to June 30, 1883, a period of 1½ years, per Government report, has been as follows:

Output of coal 92,219,454 tons, valued at the mines at $146,632,581; output of pig iron 4,623,328 tons, spot value $106,336,429; coining value of the silver mined, $46,8 0,000; mining value of gold, $32,500,000; value of copper (17¼ cents per lb.), $26,000 000; lead, $12,624,550; petroleum, $23,704,698; lime and building stone, $21,000,000 each, making a total for the whole wealth dug out of the ground without previous planting of $445,912,406, or about $8 per head.

Telephone Stock Quotations.

American Bell Telephone Company	243
Bay State Telephone Company	123
Central New York Telephone and Telegraph Company	101
Boston and Northern Telephone Company	135
Empire State Telephone and Telegraph Company	203
Granite State Telephone Company	95
Hudson River Telephone and Telegraph Company	110
Long Island and New Jersey Telephone Company	100
Mexican Telephone Company	2½
National Bell Telephone Company of Maine	90
New York and Pennsylvania Telephone Company	100
Northwestern Telephone Company	100
Southwestern Telephone Company	68
Suburban Telephone Company	139
Southern Bell Telephone and Telegraph Company	125
Tropical Telephone Company	3
Central Union Telephone Company	105
Iowa Union " "	100
Missouri and Kansas Telephone Co.	98
United Telephone Company (Kansas and Missouri)	89
Bell Telephone Company, of Missouri	165
Wisconsin Telephone Company	130
Cumberland Telephone Company	105
Great Southern Telephone Company	102
Michigan Telephone Company	100
Chicago Telephone Company	290

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUGUST 28, 1883.

283,944 Thomas Ahearn, Ottawa, Ontario, Canada; fire-alarm telegraph.

283,747 Walter A. Belcher, assignor of one-half to F. Taylor, Lowell, Mass.; telephonic apparatus.

283,748 Alex. Bernstein, assignor to Bernstein Electric Light Manufacturing Company, Boston, Mass.; automatic cut-out for electric lights.

284,114 Aaron D. Blodgett, Boston, R. M. Read, Cambridge, and J. P. Tirrell, Boston, Mass.; electric signal for railway stations.

283,759 Leo Daft, Greenville, N. J.; electric locomotive.

283,760 Leo Daft, Greenville, N. J.; rail for electric railways.

283,761 Leo Daft, Greenville, N. J.; electric locomotive.

283,763 Patrick B Delany, New York; electric cable.

283,764 Patrick B. Delany, New York; electric conductor.

283,983 Thomas A. Edison, Menlo Park, N. J.; system of electrical distribution.

283,984 Thomas A. Edison, Menlo Park, N. J.; assignor to Edison Electric Light Company, New York, N. Y.; system of electrical distribution.

283,985 Thomas A. Edison, Menlo Park, N. J.; assignor to Edison Electric Light Company, New York, N. Y.; system of electrical distribution.

283,986 Thomas A. Edison, Menlo Park, N. J.; assignor to Edison Electric Light Company, New York, N. Y.; system of electrical distribution.

283,995 George W. Gardanier, New York, N. Y.; duplex and quadruplex telegraph.

284,003 Elisha Gray, Highland Park, Ill., and F. L. Pope, Elizabeth, N. J.; signaling apparatus for telephone and telegraph lines.

284,031 Charles H. Lothrop, Lyons, Iowa; combined cut-out and ground-switch for telephone and telegraph lines.

284,137 William J. McElroy, Pittsburgh, Pa.; assignor to Standard Cable Company of New Jersey; testing lead-covered cables.

284,138 William J. McElroy, Pittsburgh, Pa.; assignor to Standard Cable Company, New Jersey; testing electric cables.

284,139 William J. McElroy, Pittsburgh, Pa.; assignor to Standard Cable Company, New Jersey; testing-box for underground electric cables.

283,806 Irwin M. O'Donel, Pittsburgh, Pa.; telephone exchange.

283,807 Elhanan Omensetter, Philadelphia, Pa.; underground conduit for electric wires.

283,927 Charles E. Scribner, assignor by mesne assignments to Western Electric Company, Chicago, Ill.; circuit for telephone call-boxes.

284,082 Henry W. Spang, Reading, Pa.; lightning-conductor.

284,098 Richard S. Waring, assignor to Standard Cable Company, Pittsburgh, Pa.; joint connection in lead-covered electric cables.

284,099 Richard S. Waring, assignor to Standard Cable Company, Pittsburgh, Pa.; truck for paying off electric cable.

284,100 Ernest P. Warner, assignor to Western Electric Company, Chicago, Ill.; telephone and signal circuit.

284,110 Karl Zipernowsky and M. Deri-Buda-Pesth, Austria-Hungary; dynamo-electric machine.

Manufacturing News.

The Lockwood Manufacturing Company, Waterville, Maine, increased their electric light plant from 250 to 600 lamps.

Iron and steel works are to be erected at once at Gunnison, Col., a company having been organized for that purpose with a capital of $5,000,000.

It is intended to put up a first-class cotton and woollen factory in Meridian, Miss. The amount desired to be raised is $150,000. Already $50,000 has been subscribed.

The Parsons Paper Company, of Holyoke, Mass., is about beginning the remodelling of its mills. The cost will be from $50,000 to $75,000.

The Time Telegraph Company of this city, are now furnishing time to all the principal jewelers here, and also to the Western Union Telegraph Company.

The Norwalk (Conn.) Lock Company have closed a contract for the building of a large addition to their present works, which will comprise a foundry and machine shop for the special working in brass.

In the *Naturforscher*, Dr. K. Mullenhoff has apparently solved the question of the cells of bees. He endeavors to prove that the peculiar form of these structures is due neither to a high intelligence nor to a miraculous instinct, but simply to certain unavoidable physical conditions.

M. Cazan insists that the chemical composition of steel rails has only a secondary influence upon their resistance; that everything depends upon the temperature at which the rails are finished in the rolling mill. At the bright red heat the particles of the metal have sufficient liberty of movement to allow of their grouping themselves into the crystalline form, which is not the case at lower temperatures and that, therefore, if brightened iron lie submitted to forging and rolling before it has cooled down it will have no opportunity of crystallizing.

A new battery has been devised by MM. Lelande and Chaperon. It is a single-cell one. The liquid used is caustic potash. The depolarizing electrode is oxide of copper, and the other pole is made of zinc. This electric battery is manufactured in various forms. Its electro-motive force is nearly one volt, and it is said to give a steady current through even a low resistance, for a good many hours. When the power, or rather energy, is exhausted, the battery can be restored to its first condition by sending a current through it from an accumulator.

The Yellowstone National Park is larger than Delaware and Rhode Island combined, being fifty-five miles wide by sixty-five long and embracing 3,575 square miles. It lies mainly in the northwestern corner of Wyoming, but includes a thin strip of Idaho on the west, and Montana on the west and north. The body of it is between 110° and 111° west longitude, and 44° and 45° north latitude. The lowest elevation in the park is 6,000 feet above sea level, and its highest mountain peak from 10,000 to 12,000 feet. It is an immense tableland, with a surface broken into mountain ranges, gorges, canons and valleys.

The effect of protecting home industries in developing the nation is seen in the fact that the total value of the exports of merchandise from the United States increased from $281,950,890 during the year ended June 30, 1868, to $823,805,810 during the year ended June 30, 1883, and the value of the imports of merchandise into the United States increased during the same period from $357,436,440 to $723, 22,666. If this ratio is kept up for another fifteen years the commerce of the United States will be nearly $2,300,000,000 annually. Hadn't we better keep the ball a rolling for a while?

BUSINESS NOTICES.

Bradley A Fiske, Consulting Electrical Engineer, 59 Astor House. Advice to inventors, calculations, etc.

SITUATION WANTED—By a young lady in a telephone exchange; has had three years' experience in the business, and is thoroughly well posted. Address Seek, Box 22, Schoharie, N. Y.

FOR SALE—United States and Canadian rights in an arc lamp; inventor desires to sell his patents outright for a moderate sum. Address "Arc Lamp," P. O. Box 3329, New York City.

Wanted—Telephone exchange manager An ambitious young man, experienced both in outside and inside work, thoroughly posted on "troubles," and possessing some tact as a canvasser.

Address, with statement of age, references and salary expected, "Company," care of the ELECTRICAL REVIEW.

WANTED—An experienced telephone man of ability who can take the position of superintendent or manager, and can speak the Spanish language. Address "M. C." care of this office, P. O. Box 3329.

WANTED—By September the 1st, a situation by a young man of large practical experience in an electric light company, to put up or run dynamo machines; can adjust and regulate lamps, run line wires, etc. Address, "Experience," P. O. Box 3329, New York.

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RANK L. FREEMAN, { Late Examiner in charge of Class Electricity / Patent Office.

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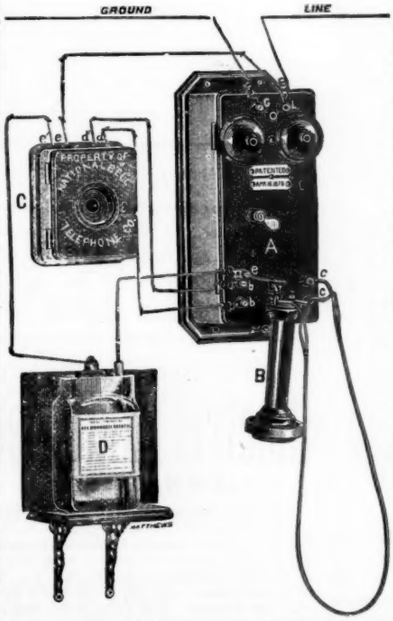

This Company, owning the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controlling, except for certain limited territory under an arrangement with the Western Union Telegraph Company, the Gold and Stock Telegraph Company, the American Speaking Telephone Company, and the Harmonic Telegraph Company, the patents owned by those companies, is now prepared to furnish, upon application, either directly or through any of its licensees, Telephones of different styles, and applicable to a variety of uses.

This company desires to arrange with persons of responsibility for establishing

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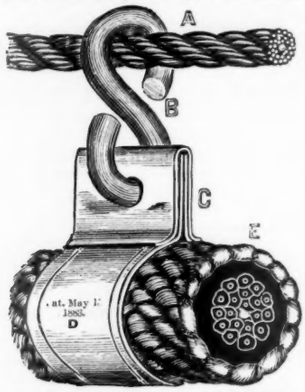

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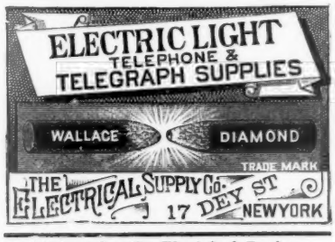

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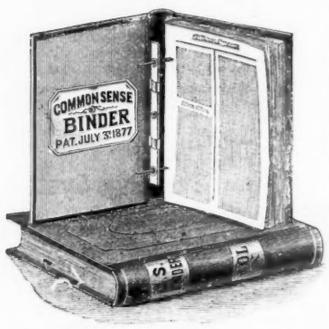

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The Commission of the International Electric Exhibition at Vienna, 1883, gives due notice to the public that this Exhibition is to take place in the course of this year, to be opened on the **1st August,** and to be closed on the **31st October,** and cordially invite Exhibitors and Visitors. The Regulations and the blanks necessary for Applications are to be had at the **Austrian-Hungarian Consuls.** The objects to be exposed will comprise all Machinery, Apparatuses and Implements connected with Electrotechnic It will certainly afford a good opportunity to inventors to show their latest improvements. This Exhibition is greatly favored by the Austrian Government, and will be held in the Rotunda of the well-remembered Universal Exhibition of 1873. Exhibitors are requested to procure the necessary papers at once.

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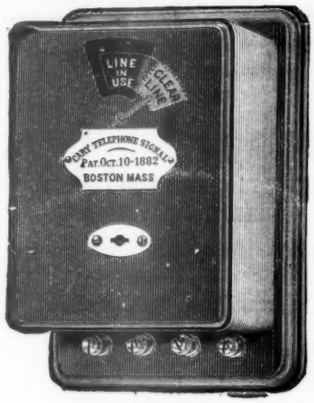

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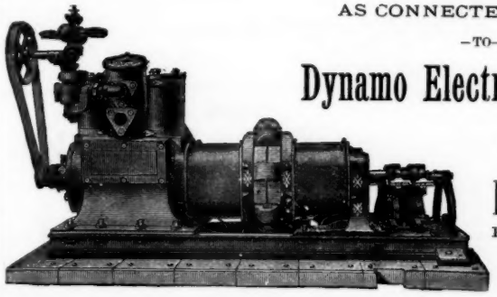

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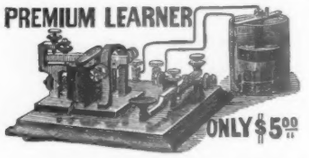

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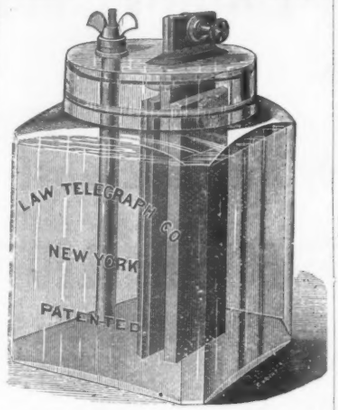

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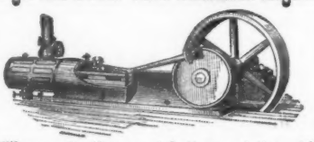

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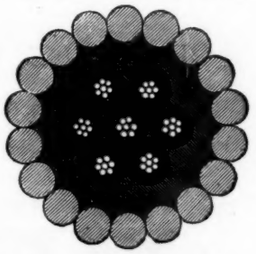

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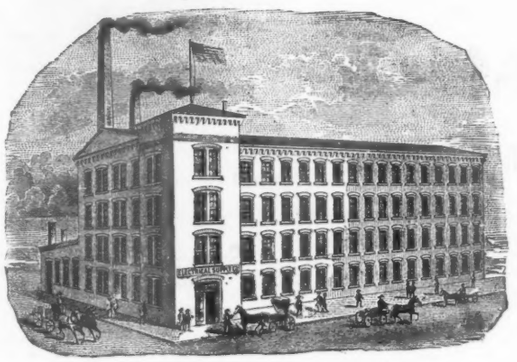

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